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Bicycle Tools—IX.

STEEL RIMS.—CONTINUED.

From the polishing room the steel rims go to the electroplating room for the coating of copper which makes the standard finish of the Gormully & Jeffery work. Nickelplated rims are finished to order only, and but few of them are made. There was a time when almost every finished metal surface was thought to be improved in appearance by nickelplating, and even steam engine and machine tool parts were so treated; but this practice was so distinctly against the true art of metal surface finishing that it very quickly, and not *too* quickly, went out of fashion, and few would now think of nickelplating any large finished metal surface of a machine or any part whatever of a machine tool or steam engine. For small finished parts of machines exposed to the weather as bicycles are, however, nickelplating is a very useful and hence very appropriate finish. All the art and theory in general of electroplating is now well within common knowledge, so that to give it here would be merely to reprint what is contained in many different and easily procurable books. It is not the intention to present anything in these articles which can readily be found printed elsewhere, therefore nothing need be said of the general methods by which the substance of a plate of metal connected to one pole of an electric battery is made to transfer itself to the surface of metallic articles connected with the other pole; the process is indeed wonderful, but it is a wonder so old that it has long ago ceased to excite attention.

There are, however, many secrets in the art of electroplating known only to those who practise them, and, so far, no superintendent of a cycle shop plating room has been questioned who was willing to furnish any part of his own personal practice for publication, or even to disclose his methods under promise of secrecy. I am therefore wholly unable at this time to say how far these individual specialties of electroplating practice vary from the book methods, or to give even a well-founded guess as to the real value of these individual methods. Except the secrets of the plating room, the Gormully & Jeffery establishment made no reservations except their japanning ovens, and as I am fortunately able to give photographs and full descriptions of ovens in use elsewhere which are almost precisely similar in detail and identical in general form and method used, readers will lose nothing in this particular.

To my urgent request for the details of the plating room practice, Mr. Jeffery replied that I could make free use of the camera, but that he himself did not know exactly what his workmen did in that room; that the head plater had methods of his own, and that was all he, Mr. Jeffery, knew about it, and he added that it was all I was likely to find out myself. When I asked the master plater for specific information he seemed lost in amazement at the impudence of the demand; when he recovered himself in some degree, he said that to give the information I asked would bring his own services down to a day wage level, and that he would certainly never give the slightest hint of his own methods for publication. As he admitted, however, that others knew as much as he did (some others,) and could produce equally good results, I do not despair of obtaining full information finally. The Gormully & Jeffery plating room turns out fine work, of course, and the head plater said that he could copper a hundred wheel rims in the time it would take to plate twenty by any formula ever printed, and that the rims he plated had a harder surface and would take a higher and more durable finish than those plated by the common methods. All of this may be true, and again, as is often the case with vaunted trade secrets, it may be found that the secrets of electroplating are like the secret of the Keely motor, money makers only because they *are* secrets, and really of no more value for use than the methods in reach of the public.

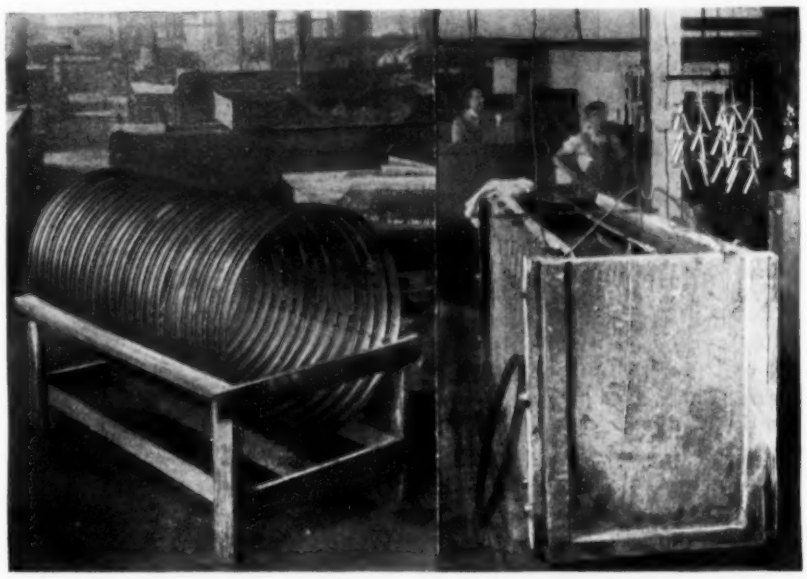
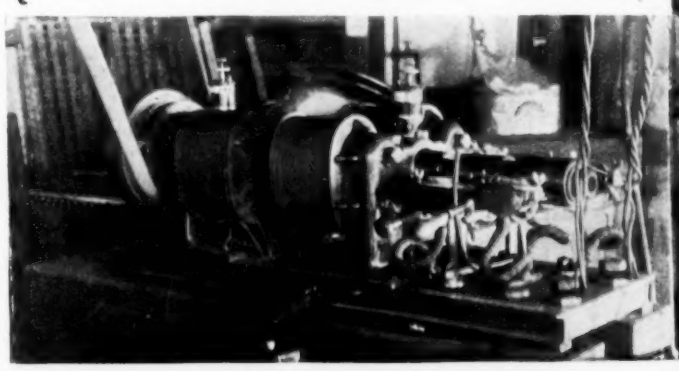


Fig. 68.

The polished rims are brought into the plating room in wooden racks, one of which, filled with rims, is shown in Fig. 68; these are simply pine strip structures, provided with rim separating pins on the insides of the top rails, and on the top of the middle lengthwise rail shown clearly at the bottom in Fig. 68. There were no rims going through the plating room when these pictures were taken, and these rims are shown in a rack too small for them, having been put up for the picture; the rim in its proper rack goes down and rests on the bottom rail. This rim rack is substantially the same as that used at the Plymouth shops for the wood rims, but the wood rim racks have to be the more carefully made to exactly support the rim and fit it. A wood rim very quickly loses its roundness if improperly supported, and so makes a great deal of useless work for the "stringers" who put the spokes in the wheels, as the spokes are in most cases put in to conform to the shape of the wheel rim, no matter how crooked and wavy it may be, and hence a rim out of shape makes a lot of work in truing up. A steel rim is not, perhaps, quite so likely to be round when finished as a turned wood rim; neither of them are very nearly a true circle; the best that can be done with them is to avoid short crooks and have them look round.



PLATERS' DYNAMO.—FIG. 70.

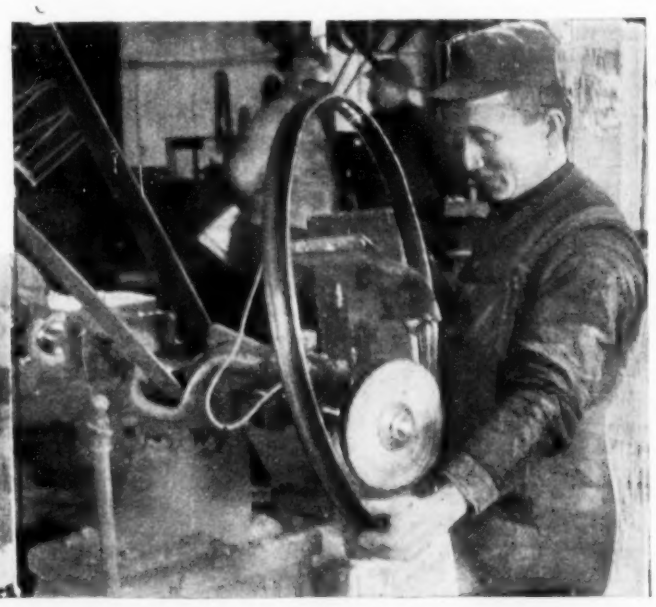


Fig. 69.

FINISHING RIMS.—FIG. 71.

To avoid this extra work in truing the wheel rim, several "stringing" machines have been devised in the form of expanding chucks with a multitude of jaws, which put the rim nearly or quite round before the spoke setting or "stringing" begins, and one of these, that devised in the "Liberty" cycle shops, is in constant use, and is held to be a great time-saver. Other attempts in this direction have proved less successful, and I have seen several such machines standing aside while the "stringing" was being done with next to no machine help whatever.

The first operation on the steel rims in the plating room is to dip them one by one in a hot bath of lye, or "caustic potash" as it is called, consisting of a 10 per cent. solution of Hanson & Van Winkle's concentrated lye, shipped in 400-pound barrels. The rims are next thoroughly rinsed in cold water. They are then scoured by hand, each rim separately, on an inclined board at the side of a water tank, with a hand brush and finely ground pumice stone, 250 to 275 rims scoured being the day's work rate, and are then again carefully rinsed in cold water. The next step is to put the scoured and rinsed rim through a bath of sulphuric or muriatic acid and water, a 5 per cent. solution of either acid being used indifferently; the information was specific on this point; muriatic and sulphuric acid are quite different in their action on steel, but I was informed that both and either were used for the 5 per cent. solution bath. After the acid bath the rims are again rinsed in cold water, and are then clean enough to wire, ready for placing in the first tub. This multitude of operations to simply clean the surface of an article to be plated shows the different meanings which the word "clean" conveys to different minds. In the household a bath of hot soap suds followed by careful rinsing and wiping with a clean cloth satisfies the most fastidious; if metal articles are scoured with sapolio or similar abrasive elements, soap and water cleaning, rinsing in hot water and drying with linen meets the extreme views of the housekeeper; in the gun factory or sewing machine shop a hot soda bath in supposed to clean work perfectly; in the plating room, where an absolutely clean metallic surface is a prime requirement, the lye bath comes first; then the brush and scouring or abrading material, and finally the acid bath, with effective rinsings in cold water, which is the nearest known approach to a universal solvent, are found needful to really clean a metallic surface; up to the

acid bath the rims are merely freed from grease and finger marks so that the acid bath can attack the entire surface and remove the outer part of the metal itself, that is to say, actually take a thin skin off the whole surface of the rim metal; then the rim is held to be chemically clean, and it must be chemically clean to have it take a uniformly adhering film of copper over its entire surface.

None of the scouring or dipping operations afforded a picture worth engraving, and, in fact, there is very little in any plating room to be disclosed by a picture.

The wiring of the rim is easily done by using inverted "A" spring clips, which spring in under the hooked edges of the G. & J. rims, and have the rod wires permanently attached at the vertex of the "V." After wiring, the rims go first into an alkaline copper bath or solution; they are then rinsed in cold water once more and afterward placed in the "duplex" solution for the final coating of copper.

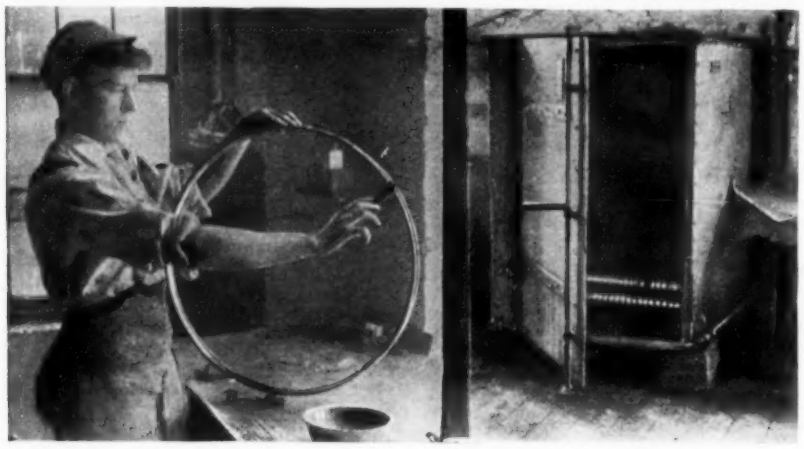


Fig. 72. LACQUERING RIMS. *Fig. 73.*

The formulæ for these two solutions, the alkaline and the duplex, are secrets which the master plater could not be induced to make public.

The plating tubs are the ordinary wooden vats shown in Fig. 69. The construction is sufficiently disclosed by the picture to enable those who choose to reproduce it, as it is without peculiarities.

The dynamos in use in the G. & J. plating room are the Brush "nickelplater," shown in Fig. 70. This is the Brush machine of 1894–5, which has a very high reputation among electroplaters. It is, as Fig. 70 shows, a horizontal machine on an inverted T-rail base, driven from a cone pulley at the rear. The photograph was taken from the machine in motion, but gives a good general idea of its appearance. The electrical peculiarities which cause this machine to give a current of such perfect uniformity as is demanded by the electroplater are not in my possession at the present time, but may be given later.

From the plating room the rims go to the polishing room, where they are put over a cotton cloth rouge buff, as shown in Fig. 71. The only noticeable features of this operation are the rather peculiar shape of the buff spindle stand, which has overhung top extensions reaching toward the workman, with the spindle boxes secured to the under sides of these extensions, and the large dust shield *S*, Fig. 71, supported on the wire *W* for the protection of the workman. The spindle is very long, and this spindle length with the top overhang of the frame extensions give the rim room to turn so that the buff can reach its entire surface. The spindle is double ended and carries a much smaller buff at the rear end, which was not used in my presence. When the rims leave the buff they have a high lustre and a fine deep red color; to preserve this desirable appearance they are passed promptly into the lacquering room, where the lacquerer supports them on a pointed block *B*, Fig. 72, secured to the top of the bench, and steadies them with the tips of his fingers in the hollow of the rim on top as shown, while he applies an even coat of thin lacquer. The rims are not heated previous to lacquering, although heating on steam tables is a very common practice in metal finishing with lacquer, and where the work is done on hot tables the lacquered articles are not, I believe, generally, and certainly not in some cases, put in an oven to dry; the heat given by the steam table is enough to dry the work quickly. The lacquer used at the G. & J. shops was not specified. For some classes of work English lacquer is held in some large establishments as far superior to anything of American manufacture. Particular information on this point will be given later; it was collected in connection with another topic and is not at hand at present writing in Chicago. It would seem that the steam table should be far preferable to the gas-heated drying oven used by G. & J., and shown in Fig. 73. This is a sheet-iron structure, with a large hinged door, quite clearly shown in the engraving, and heated with two rows of gas pipe drilled with small burner holes to give the multitude of little flames shown in the cut. I do not think it possible that the lacquer could be dried over these natural gas flames so cleanly as by heat imparted to the article previous to lacquering by a steam-heated table. This subject of lacquering will have further attention under the head of japanning. I do not believe that pure white enameled work, for instance, could be well dried over open flames of natural gas. I think the color would be likely to suffer in purity and brilliance. The work turned out by G. & J. gas-oven dried is, however, of very fine appearance, and I may be wrong as to the relative values of the steam table and gas oven for drying lacquered metal work.

HUGH DOLNAR.

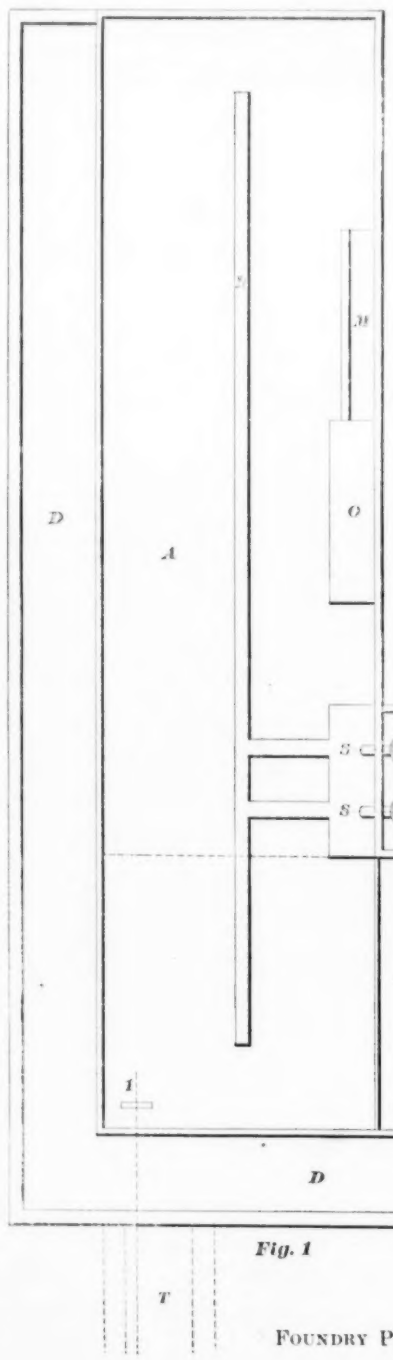


Fig. 1

FOUNDRY PLAN.

Fitting Up a Foundry.

BY CHARLES A. HAGUE.

A short time ago the writer had the task of arranging and fitting up a large foundry with cupolas, pressure blowers, elevator, a special and rather novel molding floor, and a belted power outfit.

The foundry is situated in the manufacturing center of a large city, upon property too valuable to be used for yard room, so the building itself was arranged for the accommodation of all the usual details of operation, and as most of the work was of the snap-flask order, and also of duplicate work in sets of flasks, the matter of flask storage was not so formidable as it at first might seem. A few castings weighed as high as from 1,500 to 4,500 pounds, but did not amount to very many in number.

The building is the form of the letter "L," the long leg of which contains the greater part of the main foundry floor; the short leg accommodates part of the foundry floor, also the cleaning room, tumbling mills, grinding machinery, etc., upon its main floor. The short leg of the "L" is three stories high, and the long portion of the building is a high one story structure with truss roof, thus leaving the greater part of the main foundry floor clear and free from obstruction. The second story of the short building contains a machine shop, and the third story is arranged for pattern storage, with racks and stalls which are lettered and numbered so as to bring this necessary but trying detail of foundry management down to the lowest possible terms of annoyance. A basement with a good solid cement floor, the clear hight between the floor and the under edges of the first floor, girders being 10 feet, extends under the entire building, so that one of the unusual features of this foundry is that the whole of the molding floor is supported upon columns, girders and floor beams, precisely as in the case of a warehouse. The cement floor of the basement was of unusually solid composition; there first being distributed over a bottom of good hard clay, stone spalls varying in size from 4 to 10 inches, and to a depth of 6 inches; then over this was poured and spread cement mortar thin enough to thoroughly fill the interstices, the top being finished off in the regular manner with cement floors. The sidewalks upon the two street sides of the building are 16 feet wide, and as the building stands upon a corner a considerable space under the sidewalks is available for storage of the various kinds of sand, pig-iron and fuel, removable covers in the sidewalks giving easy access for dumping such raw materials. The space under the sidewalks forms a continuation of the basement, so that supplies can be readily transported to the elevator. The main floor of the building is about 4 feet above the sidewalk, thus permitting of the use of large ports or windows, between the sidewalks and the main floor, for the further reception of materials, which through these ports went directly into the basement; the sidewalks of heavy planking were made strong enough to safely bear the heaviest teams and loaded wagons.

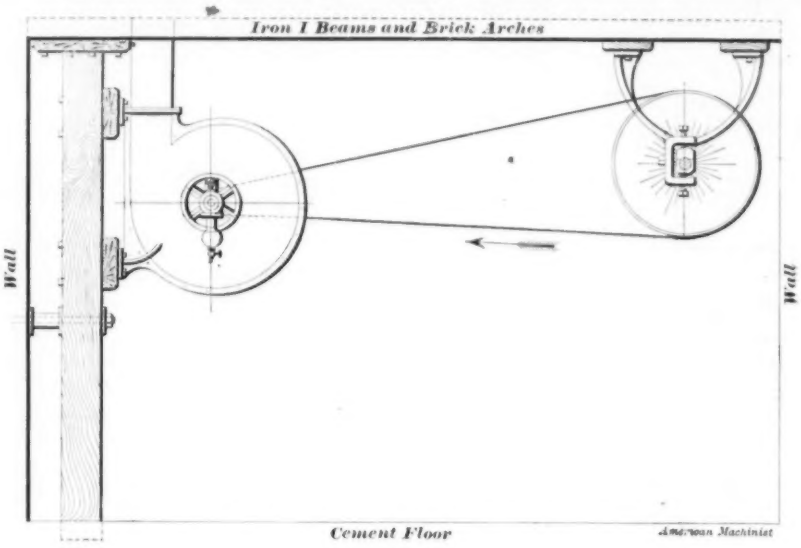


Fig. 3

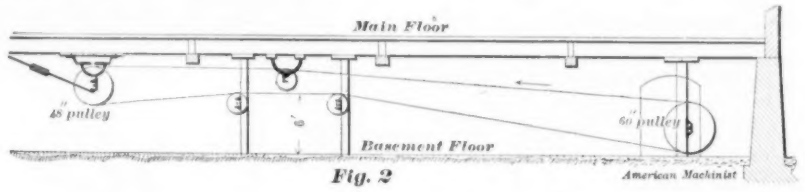


Fig. 2

The short leg of the "L" extended about 100 feet upon one street, and the long leg 250 feet along the other street, both parts of the building being 60 feet wide. The foundry floor proper extended to the front of the short part, leaving the cleaning and mill room, 40x60 feet, at the end of the short building, the main foundry floor being 250 feet long and 60 feet wide. The cupolas, two in number, were placed in a special small building, situated in the inner corner of the "L," the cupolas facing the side of the main room and with their spouts extending through the wall. This small building was absolutely fire-proof, being constructed entirely of brick and iron, and containing cupolas, charging floor, and pressure blowers; the latter being located in the basement. The charging floor was accessible from the elevator which served the building, this elevator having a platform 12 feet long and 7 feet broad.

The main floor of the foundry is peculiar in its construction, being supported upon heavy spruce floor beams 3x16, these in turn resting upon 12x12 girders, the entire mass supported by heavy cast-iron columns. The wooden flooring is 2-inch spruce plank, laid diagonally, and upon this was laid a floor of hard brick, similar to a common brick sidewalk, covering the entire main floor of the foundry proper. Runways, com-

posed of cast-iron plates ⅜ inch thick and 4 feet wide, extended the entire length of the molding floor, through its center, and also branched off to the spout of each cupola.

The melted iron was distributed to the extreme ends of the floor by means of two large tipping ladles, each holding about 1,500 pounds of metal, these ladles, mounted upon two large wheels and a steering wheel, being arranged to tip to either side, and double spouted for filling the hand ladles. The small work near the cupolas was poured by hand, the men catching the iron directly from the cupolas as it ran into the large ladles. There were generally a dozen double-handed ladles in service, so that when once the heat began generally the cupola was never plugged, but ran completely out, any small balance being run into pigs before the bottom was dropped. It was at first thought that there might be a tremor of the main floor to an extent which might endanger the firmness of the copes. A few experiments, however, satisfied the owners that the risks were really very small. When the main floor was paved, it was found that a perceptible tremor was one of its characteristics, sure enough, and before the time for the first heat rolled around some little anxiety was felt, but the very first trial swept away all the ideas that the sand would not hold together, and a better working foundry cannot be found.

As already stated, there was a machine shop upon the second floor of the short building, driven by one long line shaft through the center of the room of 100x60 feet, the shaft running lengthwise of the room. Four tumbling mills, unusually large, situated upon the main floor, were driven from a line shaft extending along the end wall of the building, these mills being provided with exhaust fan conveniences, the fan driven from the same shaft as the mills. Four heavy double-wheel grinding machines were also situated in this room; these machines of special design (by the author) were driven from a shaft beneath the main floor in the basement. The elevator and the blowers for the cupolas were also driven from shafting in the basement.

The source of power was a line shaft in the middle of a large building upon the opposite side of the street from the foundry, and the problem was whether to cross with a wire rope overhead or by means of a shaft through a tunnel under the street. All things considered, conspicuous among the considerations being the power of the city authorities, which was rather against the wire rope on account of the fears of obstructing the operations of the fire department at some time or other, and the convenience of a private means of communication between the buildings afforded by the tunnel, the decision was in favor of the tunnel.

The line shaft from which the power was taken was 3⅞ inches in diameter, and made 265 revolutions per minute. It was desired to transmit, possibly, a maximum horse-power of 75, with easy belt conditions, so a pulley 42 inches in diameter to carry a 24-inch belt was put onto the line shaft. It was considered that the most important item in the entire outfit was the speed of the pressure blowers, and therefore the speeds of the various lines to be driven were calculated with this object particularly in view, it further being decided that allowances which would even drive the blowers a little above the desired speed were to be preferred to any possibility of the contrary. Therefore allowances for slippage and loss were made at every transmission of the power from one pulley to another. An allowance of 2 per cent. of loss in speed for each pulley delivered to was made, so the drive from the 42-inch pulley on the initial line was to a 41-inch pulley upon a jack shaft at the side of the room; this jack shaft in turn, with a 42-inch pulley, drove down through an opening in the floor to a 41-inch pulley upon a jack shaft in the basement, and through a pair of miter gears the power was transmitted to the tunnel shaft which extended through the tunnel across the street. It will be interesting to know that the allowance for loss of speed of 2 per cent. was just about right under the conditions for each drive, although the loss was probably a little less for the horizontal belt, and a little more for the vertical belt; at all events, the tunnel shaft, as far as could be ascertained from many trials with a speed indicator, made just about an average speed of 265 R. P. M., which was the speed of the line shaft in the room above.

The tunnel shaft was 3⅞ inches in diameter and 80 feet long, supported upon post

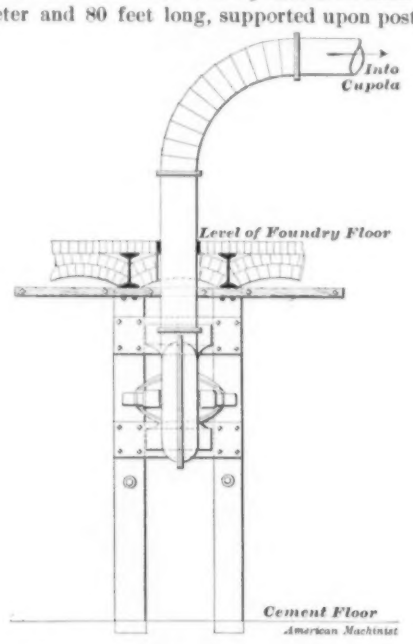


Fig. 4
BLOWER AND PIPE.

hangers at one side of the tunnel. It extended ten feet within the basement of the foundry building at the outer corner of the "L." A pulley 60 inches in diameter was put upon the foundry end of the shaft, and revolved between two solid pine posts 10 inches square, extending from the basement floor, into which they were set, up to a heavy cleat secured to the under sides or edges of the main floor beams, each post supporting a hanger for the shaft bearings. This pulley, at 265 revolutions per minute, gave a belt speed of 4,160 feet per minute, with a belt 16 inches wide.

The first line shaft in the basement, and which received its power from the tunnel shaft, was 65 feet away from the tunnel shaft and was driven by a 48-inch pulley. This line, 3⅞ inches in diameter, was supported by extra heavy hangers, and at the driving pulley a hanger was placed at each side of the pulley, each hanger being stayed by a ¾ inch guy rod, made adjustable, and led off to take the strain of the belt and prevent the shaft being drawn out of line by the driving strain. The shaft was placed as near to the floor beams as the diameter of the pulley would safely permit. The general arrangement and conditions brought the rim of the 60-inch pulley on the tunnel shaft within 6 inches of the basement floor, and the belt driving from this pulley onto the 48-inch pulley above referred to would completely shut off the passageway from the tunnel to the foundry basement, and to meet this difficulty the belt was raised and carried upon idlers, with the return to the driven pulley at the top running over one idler, and with the driving or pulling part of the belt underneath running over two idlers. This gave 6 feet in the clear between the lower portion of the belt and the basement floor. See Fig. 2.

A speed of 325 R. P. M. being desired for the first line mentioned, the ratio between 60 and 48 would give 331 R. P. M., and this, discounted 2 per cent., would just about make 325, so a 48-inch pulley was used. As the blowers for the cupolas were the objective point, as far as any particular matter of speed was concerned, they were taken up next, and the problem worked backwards, so to speak. These blowers, two in number, are No. 7 Sturtevant steel pressure blowers, mounted upon 8-inch square pine posts, two posts to each blower, in the basement room directly beneath the cupolas. The cupolas being supported upon the main floor level, so leaving the basement of the small fire-proof building clear and free from incumbrance, the arrangement of the blowers, a separate one for each cupola, was so that their delivery openings were directly upward, thus avoiding all bends in the blast pipes excepting the one necessary for the turn into the cupola. See Figs. 3 and 4.

The blowers were driven straight from a 2 7/16 line shaft making 425 revolutions per minute, they having been calculated to run at 2,300 revolutions, but the ratio actually figured up to 2,555 and then discounted 10 per cent. on account of the great difference between the pulleys on the line and those on the blowers, so that the chances are that the blowers never fell below what was decided upon as normal speed. The blower line shaft was driven by a pulley 22 inches in diameter, carrying a 10-inch belt, receiving its power from a second line shaft in the main basement, the blower line extending out into the main basement for the purpose, this second line making 319 R. P. M. and carrying a 30-inch pulley driving to the 22-inch upon the blower line, a discount of 2 per cent. being made between these two lines to allow for loss of speed, the result being a trifle above normal.

This second line shaft was driven from the first line already mentioned, equal pulleys of 36 inches diameter being used upon both lines, the speed of the second line being discounted 2 per cent., and so brought down to 319 from 325, the speed of the first line given above. The ratio between the second line and the blower line by the actual proportion gives 433 to the latter, but the discount of 2 per cent. brings it down to just about 425 R. P. M. with the leeway upon the faster side of the account.

The blower line is 40 feet long, and probably a more beautifully running shaft could not be found. The pulleys driving the blowers are 36 inches in diameter and of 6 inches face, carrying 5½-inch belts of raw hide; these 36-inch pulleys were machine molded, and one of them is so perfectly made that no balancing weight is required upon its rim, so that when running at 425 revolutions per minute the arms completely disappear and the rim appears to be mysteriously suspended in the air, as no variation or mark to catch the eye can be observed. The other pulley upon the same line and within 15 feet of the perfect one required a half pound of iron to preserve its balance, going to show that the making of two machines "exactly alike" from the same patterns and yet operating differently can be very easily accomplished. The hangers supporting this blower line shaft are secured to the iron beams which form a part of the floor above, making everything so thoroughly solid that not the slightest sound can be discerned when the shaft is running at full speed before the blowers are started.

The 30-inch pulley on the second line shaft, for driving the blower line, is a friction clutch pulley, left normally in clutch, and when it is desired to start the blowers in the afternoon the clutch is thrown out, the blower belts put on and the clutch again thrown in; this particular method was not exactly contemplated at first, the idea being to throw out the clutch and leave it out, but the blower line turned so easily that it gradually acquired considerable speed, blowers and all, so that it was thought best to throw off the blower belts and allow the shaft to run, this incidentally keeping the belts out of strain when not in use, and saving the wear upon the hub of the friction pulley.

The machine shop is driven from the first line in the basement by a quarter turn belt passing up through the first story. The speed desired in the machine shop was 125 R. P. M., and as it was evident in the nature of things that considerable difference must exist between the pulleys, and as it was further considered that the belt must be a quarter turn, it was decided to add 5 per cent. to the speed of the machine shop line before establishing the ratio. This made 131 against 325, resulting in a 48-inch pulley on the upper line, and a 19-inch pulley below. The grinding machines upon the main floor in the cleaning room already referred to are driven directly from the first line shaft in the basement by 5-inch belts, the machines being located directly above the line shaft, and the machines started and stopped by tightening or slackening individual belts for each one, one important feature of this arrangement being that when the machine is at rest the belt is both at rest and completely loose; also the drive being from below the floor, all above is free from obstruction and danger to the operator. The writer has used a good many of these grinders and they are extremely convenient and serviceable, arranged as they are with two emery wheels revolving in opposite directions at diagonally opposite corners of a heavy iron table, so that two men may work at one machine completely out of each other's way. Suitable hoods cover the emery wheels except at the working point, and these hoods are connected to an exhaust fan which thoroughly removes all gas and dust from the workmen.

A third line shaft at the end of the cleaning room, driven from the second line in the basement, transmitted power to the large tumbling mills. These mills also are provided with hoods and exhaust fan connections, so that when the cleaning room is working at full blast the atmosphere is most comfortably clear of dust and smoke, beneficial alike to the men and the machinery, resulting in more and better work at less expense in power and repairs than could possibly be accomplished under conditions of dust and dirt usually found in the old-fashioned way of cleaning castings.

Congress and the Paris Exposition of 1900.

An important petition to Congress is now in circulation, which should be immediately signed by American manufacturers, by exporters and would-be exporters, by all whose business interests are allied with the development of international commerce—by all in fact who have the progress and prosperity of themselves and the nation at heart. The paper referred to rehearses the fact that the Exposition of 1900 has been projected upon a grander scale than any previous International Exposition, and therefore affords an exceptional opportunity for American exporters and manufacturers to secure the attention of foreign buyers. The United States at the Paris Exposition of 1889 presented an appearance which contrasted in a most humiliating way with the exhibits from other nations. The lamentable spectacle was chiefly because a corps of American exposition officials was late and hastily organized, and no time was left for proper plans to secure the attention and co-operation of all American industrial elements. The manufacturers of Europe begin years in advance for an Exposition in Paris, recognizing it as the world's central mart for international trading, and they are now busily organizing for the Paris Exposition of 1900. Four years is barely sufficient to secure a display of manufactured products which will be a fair and true indication of the variety and comprehensiveness of American products, and of their many advantages to the traders of the world in price, design, workmanship and finish.

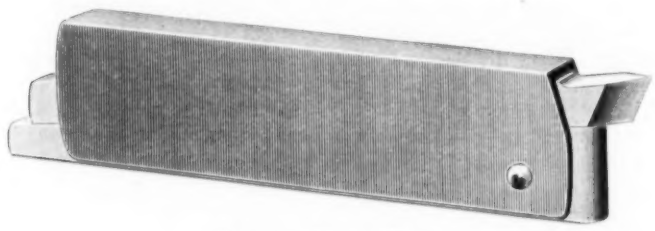
The petition asks that an adequate sum be promptly appropriated for the purpose of organizing, on a thorough basis and an extensive scale, exhibits of American products, and that the President be authorized to appoint at once a Commissioner General and an Assistant Commissioner General, who shall both hold office until after the closing of the Exposition and of the business in connection with it.

Copies of the petition may be obtained of S. Levy Lamson, 54 Broad St., New York.

It is said that an American syndicate has secured from the Chinese Government a franchise to build a railroad to run from tidewater to Pekin. It will be about 200 miles long, and will tap a valuable coal district, it is said. A. W. Bash, of Port Townsend, Wash., has arranged the affair, and prominent capitalists are mentioned as interested in it.

The Robbins Lathe Tool.

The accompanying engraving is of a new lathe tool, the distinguishing features of which are that it is entirely free of screws and all projecting parts, that the cutters are made of plain square bar steel and are very quickly and easily inserted or released, while at the same time they are securely held when in use. The body of the tool is made of steel, hardened, and in the bottom is milled a rectangular groove, deeper in front than at the rear, the inclination of the bottom of this groove being about 7 degrees, which determines the top rake of the tool. Under the tool is a wedge-shaped key which is held in place by a small pin which passes through a slot in the key, allowing it to move freely, endwise, a short distance. Thus the cutter, when inserted to its proper place, is fastened by lightly tapping upon the large end of the key, and as this key projects below the body of the tool, the tool post screw binds all together firmly. Cutters can of course be made of any desired length, and can be ground in any required form. The cut is ⅘ size of the regular 1 × ½ inch tool in which the cutter is made of $\frac{5}{16}$-inch square bar steel. This tool is made by Ernest F. Robbins, Burrville, Conn.



ROBBINS LATHE TOOL.

Column Milling Machine.

We illustrate herewith a column milling machine which is designed especially for use in architectural and other structural iron works, where many columns are to be faced.

Recognizing the importance of securing exact parallelism between the faced ends of columns, used in buildings—especially where several of these are superposed one upon another—the machine is made so that it is difficult to make the ends of the work otherwise than parallel.

The column to be faced is held between self-centering jaws, which are moved across the bed simultaneously by feed screws connected by suitable gearing.

Both heads are movable upon the bed to suit different lengths of work, and for exact adjustment of cut the cutter head is moved forward by the hand wheel seen at the left; and, when once set, retains its adjustment and will make any number of columns the same length, except for wear of the cutters, which takes place slowly.

Each head is designed to hold twenty cutters made of self-hardening steel, and the work can be advanced at the rate of one inch per minute and returned at 3½ inches per minute.

The heads are 36 inches diameter, and the machines have been built for columns up to 30 feet long, though 20 feet is the usual length.

The machine is built by Hethington & Berner, Indianapolis, Ind., and is the outgrowth of their own experience in the line of work for which it is designed; a department of their establishment being devoted to such work.

Self-Emptying Centrifugal Oil Separator.

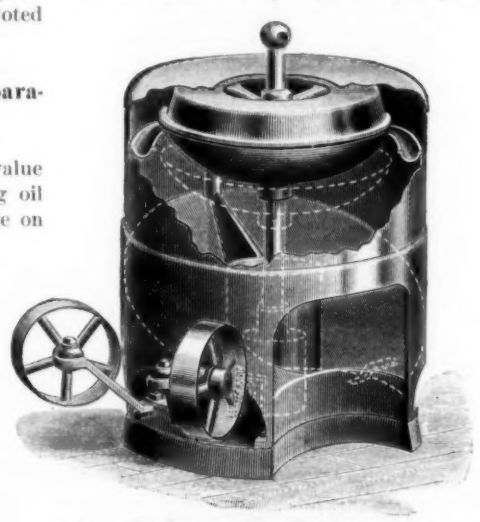
Those who have tried it know the value of a centrifugal machine for separating oil from chips or small pieces of work made on the screw machine, and our illustration shows such a machine which is an improvement in that it is unnecessary to remove the cover from the vessel, and that it automatically empties itself of chips or work after the oil has been extracted.

In operating the machine it is necessary only to throw the material from which the oil is to be separated into the open top of the machine, and set it in motion. It runs at 1,800 revolutions per minute, and the centrifugal force throws the oil out over the edge of the basin, and into the circular trough shown inside the casing, whence it flows into a pail placed to receive it. When the oil ceases to flow a simple movement allows the lower portion of the basin to slide down upon the shaft to the position indicated by the dotted lines, and upon again starting the machine the material is thrown out upon the inclined plate shown below, and is delivered outside the machine. So that the amount of handling of material is very much reduced, and the efficiency of the machine considerably increased. The machine is self-balancing, runs with very little power, and is 34 inches high, 26 inches in diameter. It is made by the Lodge-Davis Machine Tool Co., Cincinnati, O.

Progress of Worm Gearing in Europe.

It has been stated that worm gearing for electrical power transmission should only be used with low-speed motors. This statement is directly challenged by a German writer who says that high-speed motors should be used to get the best results. An account of some recent experiments is given. The worm employed was 3½ inches in diameter; it had a multiple ring bearing and engaged with a bronze worm wheel of 28 teeth, 14⅛ inches in diameter, the entire gearing running in oil in a cast-iron box. A 20 horse-power electric motor drove the worm at 1,500 revolutions, and a brake on the worm-wheel shaft gave a useful performance of 21 horse-power and an efficiency of 87 per cent. The writer was of the opinion that the efficiency of the motor if fully loaded would be increased beyond 90 per cent. if the speed were high, the worm made of tool steel polished, the worm teeth of bronze, and the friction of the whole mechanism reduced by starting disks upon both ends of the worm.

A writer in *The Engineer*, London, relates how he saved money for his firm by the use of a worm-driven contrivance. He says:



SELF-EMPTYING OIL EXTRACTOR.

A contract had been entered into—without my cognizance—by which we were to manufacture a large hydraulic press, having three tables 12 feet by 16 feet, each casting weighing about 16 tons, and this contract was taken although we had no planing machine capable of planing any surface wider than 9 feet, and no cranes in the erecting shop able to lift more than 10 tons. In order therefore to avoid the enormous expense of getting these castings machined out—quotations for which reached £450 for the three, exclusive of carriage, which would have amounted to about £90 out and home, making a total of £540—I took a large face plate which had formed part of a broken-up lathe, fitted it to a large hollow cast-iron shaft that was fortunately lying on the premises, had some castings made in segments to form a worm wheel, bolted this to the rim of the face plate, fitted a small worm to it, keyed it on the same shaft with a 4-foot pulley, and had a pattern made of a simple form of slide rest, fitted with a capstan at the end of the screw to actuate the feed. I bolted the slide-rest firmly to the face plate, formed a temporary bearing in the recess cast in the hydraulic table, and another bearing bolted to a large iron girder, which was also on the premises. The girder was bolted to a stack of foundry molding boxes by tie rods passing through the stack to plates underneath, and with a small engine of 3 horse-power to drive the pulley the apparatus was complete. With the attention of one man we machined the whole of those castings in about seven weeks, and I believe the work was accurately done, although, perhaps, not done so perfectly as it might have been in a planing machine of sufficient width. The total cost of all the new material, patterns, lifting and fixing of one of the tables, was £38, and the wages on machining the castings, substituting one table for another, until all three had been machined, was £32, the total cost being £70.

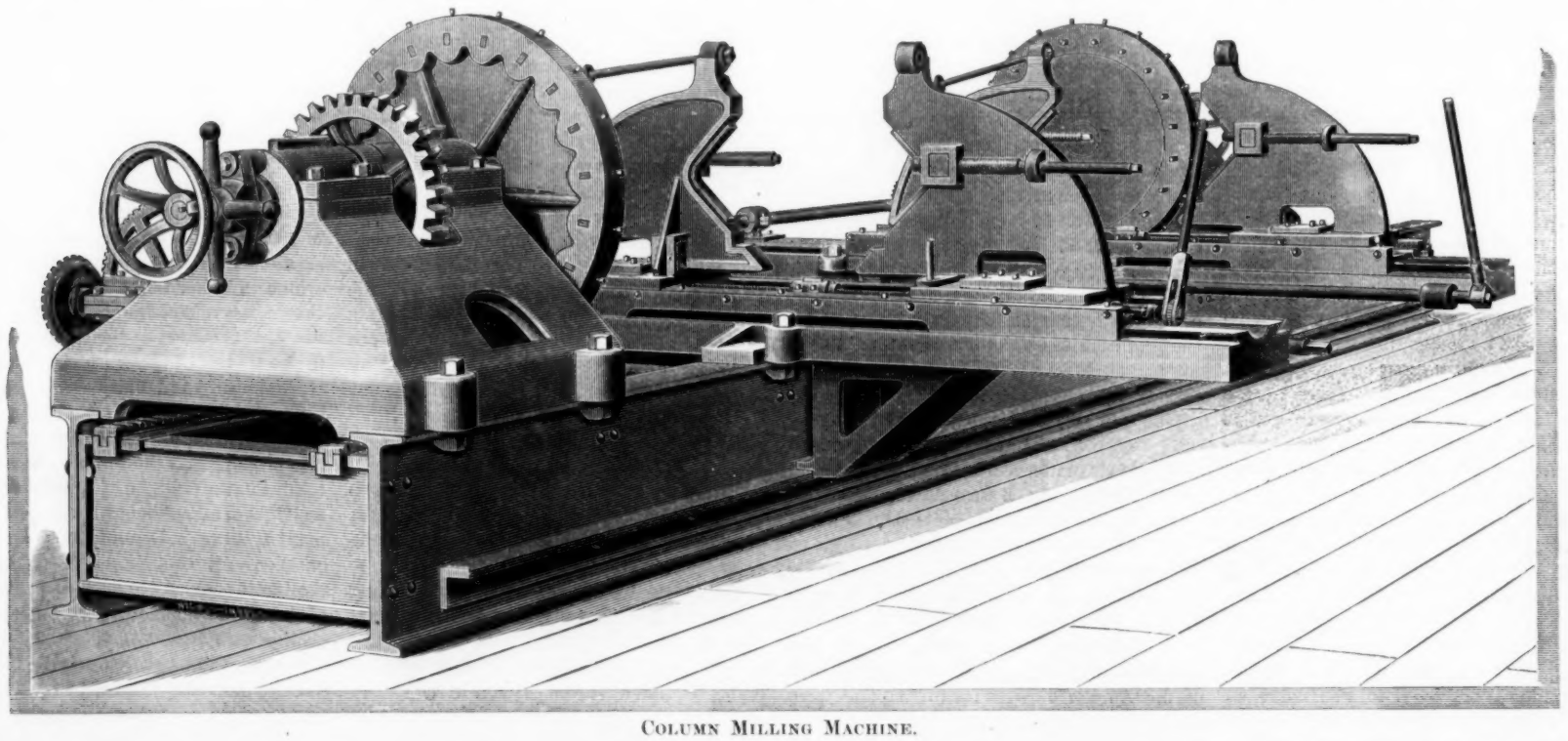
There is undoubtedly among mechanics, especially some of those of the old school, a well-defined prejudice against worm gearing, a prejudice largely begotten, we may believe, of faulty applications of such gearing in the past. We happen to know of a case where a man refused to buy a milling machine, that otherwise suited him exactly, because the main spindle was driven by a worm, and bought a spur-gear machine that was far less adapted to his purpose. Some worm gearing in use in these days upon elevators is doing excellent missionary service for the cause of worm gearing in general.

To Teach Locomotive Engineering.

The University of Minnesota at Minneapolis has taken up "locomotive engineering" as a branch of study and will teach that branch of mechanical engineering which pertains especially to locomotive designing. The work will be under the direction of Prof. H. Wade Hibbard, of whom the prospectus issued by the university says:

In preparation for this specialty, after graduation from Brown University, he spent three years in the shops of the Rhode Island Locomotive Works. After a technical course at Cornell University he had experience in designing and testing for three years under the mechanical engineer of the Pennsylvania Railroad. During this time one summer was spent under salary in Europe, studying foreign locomotive engineering. The Chief of Motive Power referred in the highest terms to his work as an engineer.

He then became chief draftsman of the Lehigh Valley Railway system, performing the duties of mechanical engineer in locomotive and car designing, shop machinery, and other general railway work advisory to the Superintendent of Motive Power. The eight and ten wheel locomotives and tenders designed during this time have been fully



COLUMN MILLING MACHINE.

illustrated and very favorably commented upon by the railway press. Professor Hibbard is a full member of the American Society of Mechanical Engineers, and of the American Railway Master Mechanics' Association, being now chairman of the committee upon locomotive grates.

THE OLD WAY.

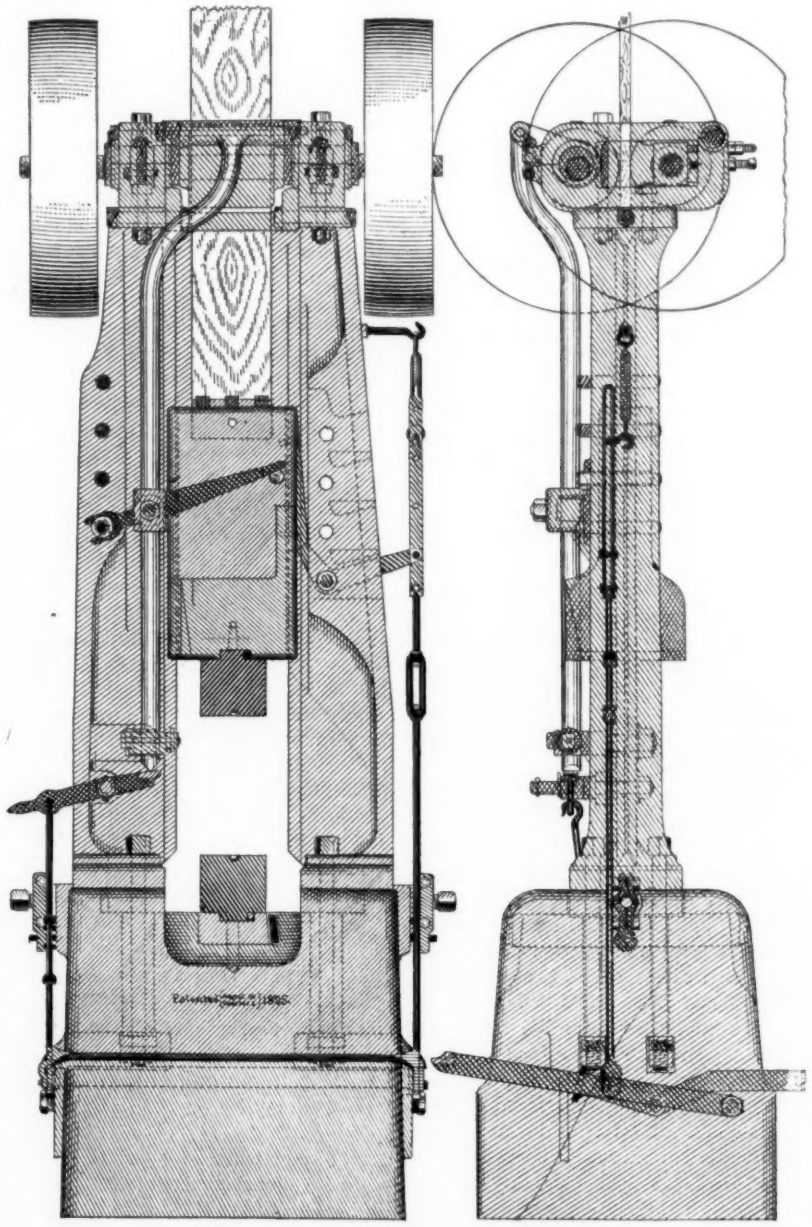
The Development of the Drop Hammer.*

BY C. E. BILLINGS.

From 1847 to 1862, among the green hills of the State of Vermont, there was located one of the best equipped plants for the manufacture of machine tools in this country. It was there, in the years of 1854 and 1855, that most of the machinery was built for the manufacture of the then celebrated Enfield rifle for the English Government, on the interchangeable system. Previous to that time they had made their fire-arms on the "cut and try" plan, or by what we would term in this country hand work. The parts were made in different shops; for instance, one manufacturer was skilled in making the barrel; another, the stock; another, part of the lock, and so on through the list. The various parts were assembled at the Tower of London, and it was there that the "cut and try" plan commenced, filing a little here, clipping off a little there, with several trials before the parts would go together satisfactorily.

On the introduction of American machinery and tools, all this was changed, for it was possible to machine the pieces of the arms so that parts of the same kind would be exact duplicates of each other; consequently the cost of production was reduced and the quantities in a given time increased over the old method.

To America is due the credit of introducing the interchangeable system in the manufacture of fire-arms, sewing machines, watches, etc.



MODERN DROP HAMMER CONSTRUCTION.

It was necessary to have uniform forgings so that they could be handled in special fixtures adapted to the different parts. The art of forging in dies at that date was the weak point. Drop hammers had not come into use, and all the forgings were made by the old hand swedging process represented by this sketch. A base of cast-iron with suitable opening in the top for keying the guide stock and lower die, the upper die made to work freely up and down in the guide stock. In the faces of the two dies were cut the forms of the parts to be forged. The power used was hammer and sledge, wielded by the smith and helper.

So far as I have been able to learn, drop hammers were first used by Col. Sam Colt about the year 1853, in the manufacture of the celebrated revolving fire-arm that bears his name.

The hammer of the Colt drop was raised by a vertical revolving screw. In the first year of the war, Golding & Cheney obtained United States patent on a drop hammer, the principal features of which were raising the hammer by a leather belt between friction rolls. These friction rolls are in use to-day on what are considered the best hammers for drop forging. In other respects there have been great improvements. Some of the latest of these improvements I will endeavor to explain.

COUNTER-BALANCED TREADLE

Is made from one piece of steel forging. The advantage of this construction is that it does not become "shackly" from wear, and when the pressure is put on one side the opposite side acts simultaneously, and the mechanism on either side of the machine does its work as it was designed to do. Instead of springs to hold the treadle in a raised positioa, a counter-balance is provided which runs across the back of base and is attached at either end to levers whose fulcrums are pine driven into the sides of the base, the short ends of the levers having projecting points extending underneath the sides of the treadle and holding it in the raised position desired.

The improvements claimed for the counter-balanced treadle are that the pressure required is the same at the start as at the finish of the movement of the treadle, and that the construction is such that repairs are not frequently needed, as in the cases where the springs or pulleys and chains are used.

COMPOUND LEVER DEVICE

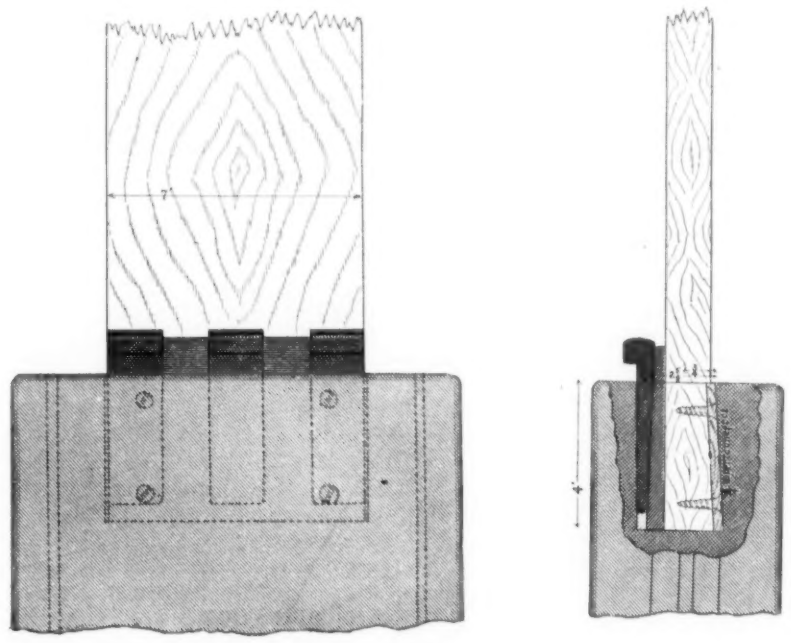
For operating the lifting or head mechanism. This device was designed with a view to lessen the shock of the blow given to the "friction bar" by the hammer when in operation. It consists of a clamp on the friction bar, having a projection on the inner side, which acts as the fulcrum of the lever, whose short end is a fork which engages with pins projecting from the left hand upright, and whose long end is actuated by a pin in the hammer, which pin is placed as near the right hand side of the hammer as is practicable, in order to enable the long arm of the lever to be made as great a length as possible, thereby reducing the speed of the movement given to the friction bar, and incidentally the shock of the blow.

All of this tends to obviate the necessity of repairs, as it reduces the tendency of the friction bar to become crystallized, and it imparts to all the friction mechanism a moderate, easy motion, which is conducive to the durability of that part of the machine.

Another feature of this device is the ease with which it is adjusted for the different hights from which the hammer falls. There is only one nut to turn, and when this is loosened the clamp is perfectly free upon the bar and will drop from its own weight, or can be raised with one hand. This one nut is sufficient to hold the clamp in place, as the latter is not subjected to the sharp blow as in the old method.

JOINTED SWINGHEAD CONSTRUCTION.

The main idea of this construction is to lessen the expense of repairs. The two sides of the head are connected by a heavy web at the bottom edges, through which there is a rectangular hole to accommodate the board. The upper halves of the two sides are fastened to the main head-casting by a hinge-joint at the rear, and are primarily held in place by small swivel bolts, same as used on a lathe center-rest, and incidentally by two of the head bolts which pass through the upper and lower parts of the head and through the top of the uprights.



FASTENING BOARD TO HAMMER HEAD.

By removing two bolts and loosening two more, and swinging open the caps, it is possible to remove any part of the head in detail, obviating the necessity of taking off the entire head by means of blocks or hoists when repairs are needed.

On both sides of the machine, running horizontally through the upper part of uprights, through the web of the lower part of the head and into the rectangular hole in the latter, good stout bolts are used which hold the upper part of the machine rigidly together, and relieve the head bolts proper from all shearing strain and also obviate the elongation by wear of the holes in the uprights. The eccentrics are made of steel castings, which are stronger and more durable than bronze or gun metal. These are chambered and babbitt lined, this lining being easily replaced when worn out. The sliding rear boxes for adjusting the friction are operated in the usual way.

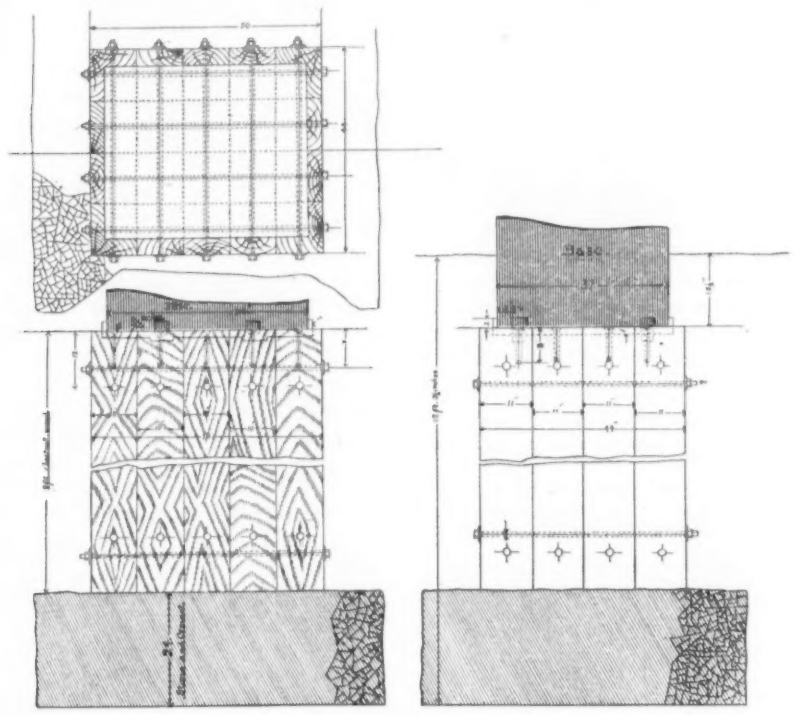
PAPER PULLEYS.

Experience has shown that iron pulleys are not reliable for drop hammers. They become crystallized and break, and some one is likely to get hurt. Wood pulleys with iron hubs are very good, but the compressed paper pulleys give the best satisfaction. They are light as compared with their strength, are elastic, and give excellent belt surface.

*President's address delivered at the annual meeting of the American Society of Mechanical Engineers, Dec. 2, 1895.

METHOD OF FASTENING BOARD IN HAMMER.

An oblong cavity from 4 to 8 inches long, and about 5 inches deep, by 1½ inches wide, is machined in the top of the hammer. That side of the cavity which is toward the back of the hammer has a bevel of about 15 degrees, the cavity being smaller at the top than at the bottom. The front side of the cavity being straight, the rear side of the lifting board has a bevel corresponding to that on the rear side of the cavity. The board is dropped into the cavity, a steel plate placed against the front side of board, and two or three steel wedges lightly driven with a hand hammer between the board and the front side of cavity. At every blow of the hammer, when the machine is working, these wedges become tighter and the board more firmly held.



DROP HAMMER FOUNDATIONS.

FOUNDATIONS, AND INCIDENTALLY THE RATIO OF THE BASE AS COMPARED WITH WEIGHT OF HAMMER.

There seems to be a variance of opinion in regard to the proper foundation for a drop hammer. Several articles have appeared in the technical journals in regard to same. Some favor a rigid, rock-like foundation, and others favor an elastic construction. It seems to me that the weight of the base of the machine as compared to the weight of the blow given by the hammer should have more or less consideration in determining the construction of the foundation. It is apparent that if a man tried to do some hand forging with an ordinary flat iron held bottom up between his knees for an anvil, the results would not be altogether satisfactory, but if it were possible for him to hold a piece of iron weighing, say, 400 pounds on his knees, he would do more execution with his hammer and in addition could stand some pretty good blows from his helper's sledge. From this illustration I argue that if the base of a drop hammer should be made heavy enough, no foundation whatever would be required. The inertia of the mass of metal would be sufficient to absorb the effects of the shock imparted by the blow of the hammer.

The cost and difficulties of handling, however, make such construction out of the question. Within the past few years an increase in the weight of the bases of drop hammers has been a move in the right direction. In deciding this point, a certain ratio between the weight of the hammer proper and the base is considered. In former years the ratio of 6 or 8 to 1 was considered sufficient. This was increased by some machine builders to 10 to 1, and now the most modern practice advocates a ratio of 15 to 1.

To return to the subject of foundations, I would not venture to say which construction will give the best results, owing in a measure to the variation of conditions, particularly the foundation of the earth where the machine is to be located. In fairly hard ground, such as clay, or where "hard pan" can be reached within fifteen feet of the surface, the following construction will give satisfaction: At the bottom of the excavation put in two or three feet of broken stone and Portland cement; on top of that place chestnut timbers on end. These timbers to be sawed on four sides and bolted together, the section of this block to be of sufficient size to accommodate the base of the machine and to have about 4 inches margin. It is preferable to have the upper end of the timbers several inches below the surface of the ground, as they will then be less liable to decay.

With a base of right proportion and a properly constructed foundation, the old method of fastening down the base with anchor bolts is unnecessary. Angle irons at the corners of base fastened down to the foundation with lag screws will answer the purpose.

LETTERS FROM PRACTICAL MEN.

Machine Building—Important Points Overlooked.

Editor American Machinist:

The writer, being in a position where it is necessary to superintend the starting of new machines received from different makers, is annoyed and delayed because there are no directions for starting, speed, etc.

We look up builder's catalog, find a cut of the machine with perhaps a size number and description of what the machine will do, but have to use our judgment in starting, and as it is always best to go slow where we are not sure, we start slow, then experiment by trying different speeds; when we find the speed that does the work to the best advantage, we put on permanent pulleys and belts. All of this should be done by the builders of machines, as much valuable time is lost and good machines have been condemned, even returned, because they did not give good results, mainly on account of no directions for starting.

We received a machine lately from a firm that has caught on to this very necessary rule of sending instructions. They went so far as to stencil on face of countershaft tight and loose pulley, "250 revolutions per minute," with arrow for directions.

Another and more essential point is that many firms assemble machines and hurry them into crates or on skids without testing at all. When these machines are set up in buyer's factory, they are criticised by many. Some of those who criticise may possibly be prejudiced; others prefer some other kind; all this is hard enough with a perfect working machine, but when we start and find "this a little out," and "that a little out," "a nut gone," "no oil hole," "too much play in some parts," "other parts too tight and will not start at all," the workmen turn and smile; then you will hear the verdict, "no good," "send it back," "I told you so," etc.

The machine gets a black eye at once from the workmen, who keep up the cry of no good until the company get the thing going in fair shape; then they decide to buy the next machine of some other builder. Does it pay?

If we write for instructions for starting, speed, etc., we get the reply that they think such a speed would be about right, but they are not sure, as they had never tried it.

Should not a machine which is built to use in these times with the present close competition be as thoroughly tested in all its parts as a watch or clock which does not cost near as much? A watch or clock is run and adjusted before shipment. A machine should be tested before it is shipped by running at different speeds. When the best speed is found, it should be stencilled on countershaft pulley and recorded in catalog. The different parts should be tested by running long enough to be sure there are no weak places where trouble will surely come and some one put to expense for repairs that ought not to be in a new machine.

I am quite positive if machine builders would run a new machine as it is advertised to run, before shipment, many would not be shipped at all, and only perfect machines would be received by the buyer, who would be pleased. The shop critics also would be pleased, the "I told you so" fellows would be hushed, and many duplicate orders would be sent to the builders that they do not now receive.

G. W. WRIGHT,
Supt. Motive Power, Sargent & Co.
New Haven, Conn.

Job Shop Management.

Editor American Machinist:

I want to know the best method of putting the details of work through the shop, and have no doubt that this is a subject more or less interesting to those who, like myself, have been earning a living in this occupation. Having worked as a machinist in many shops in which there were no systems of any kind, I have evolved one which I have used for several years past, and find it very satisfactory. I am not speaking of the manufacturing shops in which the same kind of work is performed year by year without change—such shops after being started run themselves. I have heard men who were in high positions in manufacturing concerns say they would rather be in trades than to attempt to manage a jobbing shop. Now with the system I use I find no difficulties in handling all the odds and ends which it is possible to bring into a shop. The first thing to do in any case is to find out distinctly what is wanted. Then make an itemized list; this not only familiarizes you with the details, but preserves a record of the work performed, and is good evidence in establishing the justice of a bill in dispute. From this list a shipment may be checked over or the work may be readily got together again, if from any cause there is a delay in its progress through the shop. If from this list individual orders are made out for each piece, the whole shop may be concentrated and set to work on this individual job and the whole thing pushed through in the shortest possible time. To go a step farther with these item orders, I have them with the instructions printed on that the order must, under no circumstances, be separated from the work it identifies, but passed forward until each operation has been performed as specified. By giving men written instructions, and sketches where convenient, you not only save your own time and patience, but theirs as well. Their product is also greater, because they *know* what is expected of them, and going about it with clearly defined ideas more and better work is the result.

In connection with these orders, in a shop running sixty machine tools, I used signal boards at each tool; these boards are 12 inches wide by 18 inches high, and furnished with brass screw hooks to hang orders on; the lower half of the boards were varnished with orange pattern varnish, the upper half black. The orders for pieces coming to a tool would be hung on lower half of board. After the work on a piece had been finished so far as that tool was concerned, the workman hung the order on the upper part of board. The white order on the upper or black part of board was a signal for the shop porter to come and take the piece and its order to the next tool, where the same action was again gone over. This shop porter was a man having the ability to detect and report any defects found in the work. And by this system of signaling it is not possible for a piece to be left lying at a machine. Once started it must go through the shop.

I use common manila shipping tags for orders, specially printed with places for sizes, pattern and drawing numbers filled in, and where a shop has check messengers on call the tool hands need spend very little time away from their posts.

W. H. CHAPPELL.

A Face Plate Job.

Editor American Machinist:

One day while I was working at the Marine Engine Works we had a new man come in; he was a smart looking fellow, about 25 years old, had on "store clothes" and a white necktie; now, white ties were not common at the Marine Works and this one impressed me a good deal. Well, the boss started him on a lot of parts for some small stationary engines that we had under way, centering up the crank shafts and roughing out the lathe work. It did not take him long to tell us what he did not know, he knew it most all; had, as he told it, about twenty years of experience on engine work of all kinds. The second day he started to bore out the fly wheels; they were a small, chunky wheel, with the hub sticking out beyond the rim and a 2-inch hole cored in them to be bored out to 3 inches or 3½ inches. He strapped the wheel on to the face plate putting the hub up solid against the plate. (I wondered why he did not block it out a little, but I did not feel like trying to show him anything; he was away above me.) He put the job on in good shape and got a big, flat chuck drill and took out the scale and then put in a tool to finish the hole; I thought the lathe made a good deal of fuss over the job, it would spring and clatter so, but White Necktie seemed to think it was all right, so I held my tongue; he had got the hole nearly out to size when I heard a commotion over that side of the room, and grabbing a tool I started over to the grindstone to see what was up, and, what do you think?—the blamed fool had bored out the wheel and face plate also until he had cut out the whole end of the lathe spindle and the face plate had fallen over on to the ways of the lathe. A madder man than the boss was it would be hard to find, and it was only equalled by the speed with which White Necktie picked up his kit and got out of the shop. The spindle of the lathe was utterly ruined, and a new one had to be in its place.

I stayed in the works nearly four years, but white ties were not worn much in that time.

A. P. PRESS.

Typesetting by Machinery.

Editor American Machinist:

Reading that note on "Machine Typesetting" in yours of December 5th, and also in several daily and other papers, I am tempted to avail myself of the right to ask some questions.

If I know what an "em" is, the operator must have touched about twice as many keys as he set ems, or 157,400 in 7 hours, at the rate of over 6 per second. Pretty fast!

On what sort of work did he reach that speed? I read of a typewriter contest in which the operator wrote an astonishing number of thousands of words an hour, and, on making inquiries, I found that it was on a memorized short sentence, such as "The boy ran up the hill, the boy ran up the hill, the boy," etc. I don't call that a fair test of

work, although it reads well as an advertisement—with the sentence left out.

How long did it take to make the corrections and get out the 8,000 bad ems? Would it not be honest to score time on the corrected work?

How long did it take Mr. Green to recover from the trial so as to be able to do a common day's work? I once heard of a wood sawyer who held his arm out straight in the air for half an hour on a wager, but he sawed no wood for a week afterwards.

Did Mr. Green take an hour for dinner? That is customary, I believe, and gives the fingers a rest.

Did Mr. Green set any type at all? I have an idea that Mr. Green and the whole story is a "fake." I wish I had the faculty to get my products advertised by such means, but, some way or other, when I lie some one always finds it out at once. Therefore, I always tell the truth.

Lexington, Mass. G. B. GRANT.

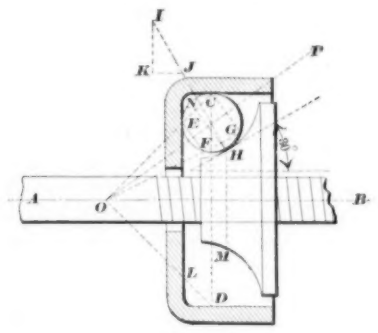


Fig. 1

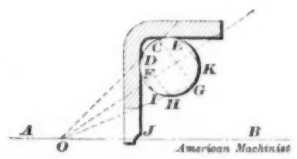


Fig. 2

Ball Bearing.

Editor American Machinist:

In the issue of October 17th, Mr. Beach, speaking of friction in ball bearings, says, referring to his sketch, that the ball will slip at the point *S*. I desire to take exceptions to this statement as follows:

In Fig. 1 the ball is tangent to its bearing at points *E* and *C*. Through *E C* let a line *C E O* be drawn, intersecting the axis *A B* at *O*. Draw *O P* through the center of the ball, *E F*, and *C G* perpendicular to *O P*, *O G*, *C D* perpendicular to *A B* and *O D*.

In *O C G* and *O C D* we will have the projections of two cones that will roll together since they have a common vertex at *O*, and the frustum *E F G C* will roll upon the frustum *E C D L*. The bases *C G* and *E F* have rolling contact, respectively, with the bases *C D* and *E L*. Since the circumferences of *C G* and *E F* lie in the surface of the ball, it is evident that the ball will have the same motion in its bearing as that of the two frusta referred to. The ball then has pure rolling contact at both *E* and *C*, and will rotate about axis *O P*.

The cone, shown in contact at *H*, will have pure rolling contact with the ball, as will appear if planes are passed through *H* perpendicular to axes *A B* and *O P*. These planes will cut circles *H M* and *H N* from the cone and the ball, respectively, which will have a common tangent at *H*, and since these circles will both roll upon this common tangent, they will roll upon each other.

The pressure of the cone upon the ball is transmitted in the direction of the common normal to both or along *H J*. The diagram *J I K* shows *J I*, *J K* and *K I* as representing the relative pressures at points *H*, *E* and *C*.

This bearing will work with pure rolling contact, as shown, except the sliding between the balls, until the bearing becomes worn, as in Fig. 2, when sliding friction appears. Supposing the ball to roll in its bearing at points *C* and *D*, there will be sliding along the arcs *C E* and *D F*. At *E* the amount of sliding for each rotation of the ball is equal to the difference in length of the circumferences of circles *C G* and *E K*. At *F* the amount of sliding for each rotation is equal to the difference between circumferences of circles *D H* and *F I* multiplied by the ratio $\frac{F J}{D J}$. It would appear then that when worn the friction along *C E* is considerably more than along *D F*.

A. L. WESTCOTT.

Notes on the Invention and Development of the Slide Rest.

Editor American Machinist:

The article on this subject, in your issue of Oct. 31st, is very interesting. So many names have been mentioned in connection with the invention of the slide rest, and the term has been used to describe so many forms of rests, that it would be a difficult matter to assign to any man the merit of having been the original inventor.

In addition to the early slide rests mentioned by Mr. Durfee, Bramah patented one in 1794. David Wilkinson, of Newburyport (an Englishman by birth), is spoken of as the original inventor in America, and he patented one in Philadelphia in 1796. He received considerable sums of money from the government for the use of his rest in the U. S. arsenals. Wilkinson died about the year 1855. Perhaps some of your correspondents can give some information concerning this slide rest.

The early French slide rest referred to is described by Jacques Besson in his book, "Des Instruments Mathematiques et Mechaniques," the first edition of which appeared in 1569, and is illustrated on plate 9 of that work. The plate shows a machine of very primitive construction, which scarcely deserves the name of a slide rest in the modern sense of the term. It is not a pole lathe, but a reciprocating motion is given by the turner. An overhead shaft carries a flanged pulley, round which a cord takes three or four turns, one end descending to the hand of the operator, and the other being attached to a counterbalance weight at the back of the lathe. A second cord from this shaft conveys motion to the spindle, the traverse of the slide carrying the tool being regulated by a guide screw at the end of the lathe, which is driven by a third cord from the upper shaft. A tooth, connected with the tool slide, engages in this guide screw, giving the desired advance, and the traverse of the slide is assisted by a sliding bar below the bed of the lathe, which appears to be controlled by the foot of the workman.

A very early form of slide rest was the old fusee engine, for turning the fusees of watches. This was described by Theout, as far back as 1741, in his work on clockmaking (Paris, 1741). Motion is given to the tool slide by a screw geared to the spindle of the machine, so I think it may be called a slide rest on a very small scale.

The illustration from Cherubin's work is very curious, but this can hardly be called a slide rest. I think it will be acknowledged that the term slide rest conveys the idea of an apparatus for guiding the tool in a straight line parallel to, or at right angles, or any other angle to, the axis of the lathe. Cherubin's lathe complies with none of these requirements. It is adapted neither for cylindrical, surface, nor conical turning. It appears suitable only for work on lenses. Indeed it might be almost looked on as the prototype of the so-called spherical rest, for ball turning.

The sketch from the French "Encyclopedie" shows a rest which fulfils all the requirements of a slide rest, and is very similar to many that appear to have been constructed about the beginning of the present century for very light work. It is far in advance of the other rests referred to, but is not the shoe turned the wrong way in the drawing?

Bergeron shows slide rests very similar in construction. Plumier's work, which first appeared in 1701, and again, with additional plates, in 1749, makes no reference to slide rests. I have never seen the edition published in 1776.

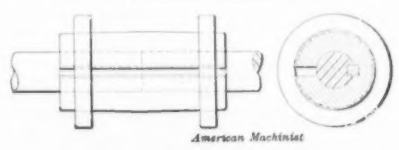
The literature of the lathe, particularly in the English language, was very meagre in Maudslay's time, but it is probable he knew what had been done in the way of slide rests, which were suitable for very light work only. Whether he evolved his rest from these, or whether the idea was original as far as he was concerned, it is not easy to say, but he is fairly entitled to the credit of having developed the slide rest and made it a tool for practical use in our workshops.

Mr. Durfee gives a very interesting description of this slide rest, with the illustrations which appeared in Gregory's Mechanics in 1815, but surely he is not serious in asking us to take these drawings as representing the slide rest designed and constructed by Maudslay. Gregory's was an excellent text book and the diagrams are good enough, but many of the perspective views of the apparatus described are exceedingly bad. Seventy or eighty years ago it was a difficult matter to get a decent engraving made of any piece of machinery, and many of the text books which were published long after Gregory appeared give most ludicrous illustrations of comparatively well-known machines. It is only since the various styles of process printing from photographs have been introduced that we find good perspective drawings in the cheaper class of mechanical text books. I am inclined to think that a photograph of Maudslay's slide rest would show a very different machine to that illustrated in Gregory.

James Nasmyth, speaking some thirty or forty years ago, mentions having seen the first slide rest made by Maudslay, and stated that it comprised all the arrangements of the modern slide rest of that day. We have it on the same authority that Maudslay was most particular about the disposition of the material in the construction of his machines, putting metal where it was needed, but leaving no superfluous material in places where strength was not required. Moreover, one of Maudslay's chief aims in perfecting the slide rest was to obtain means of making accurate screws. After much labor in this direction he succeeded in turning out a screw some seven feet long, which at the time was considered a marvel of accuracy, being short of its nominal length rather less than one-sixteenth of an inch. It appears to me that it would require more skill than even Maudslay possessed to turn out such a screw with the slide rest illustrated in Gregory.

It is easy to understand that the slide rest would be slow in coming into general use until after the introduction of the planing machine by Joseph Clement about the year 1820, as the difficulties of construction and the consequent expense must have been very considerable. Another thing which rendered the slide rest unsuitable for many of the lathes driven by foot power a hundred years ago was the very general use of the pole lathe or bow lathe, in either of which, the spindle having a reciprocating motion, there would be the difficulty of withdrawing the tool from the work during the reversal of the lathe. It is curious to note that some of the foot lathes made about the beginning of the century and supplied with the wheel and treadle were also equipped with the pole.

Ottawa, Can. F. CHADWICK.



A Shaft Coupling.

Editor American Machinist:

As you have asked to hear from your friends who build and operate machinery, and as I have received many valuable suggestions from others through your columns, it has occurred to me that some of your readers might be interested in what I have learned by experience in the way of shaft couplings, a subject of minor importance perhaps, unless they are to be dealt with in quantities or under conditions which require occasional taking apart.

I was brought up in one of the old New England machine shops, whose existence dates back to the days of square shafting, when it was doubted that anything like a pulley could be held from turning on a round shaft. The square shafting idea soon gave way, and the turned article came into general use about the time that the first New England cotton mills were put in operation.

The flange or plate couplings, as then made for nearly all line shafting, are to a great extent used at the present time and are, aside from their cost and inconvenience of handling, probably as serviceable as any, provided that they are properly made and fitted; and if not, they are an abomination, as any one knows who has had to repair a loose one after the key has enlarged its seat by trying to turn over in it.

For about twenty years I watched the manufacture of shafting, hangers and couplings in that shop, as also many other lines of machinery, during which time the A. & W. Sprague Mfg. Co. were in the hight of their prosperity and a large portion of their machinery was built there.

Until within about ten years of the present time, all shafting was turned in an ordinary lathe, with a single tool post, and patented couplings were almost unknown.

About five years ago I assumed charge of the machinery in an extensive manufacturing plant near Philadelphia, in which I found a variety of couplings, and the nature of the business being such that frequent changes or additions of shafting and pulleys were necessary, it afforded an excellent opportunity for judging of the merits of the various styles of couplings.

In removing and replacing sections of shafting, I found one style of coupling to be so far ahead of all the rest for reliability, quickness in stripping or adjusting, cheapness and the certainty of its strength in transmitting power, that all others have sunk into the background of my estimation.

This coupling may be familiar to many of your readers, but I have never happened to see any of them elsewhere. They consist of a plain cylindrical casting about double the shaft diameter and about four times in length, with a slot about one-quarter or three-eighths inch wide, cast lengthwise from the outer surface to about one-half inch from the core. This is bored to a neat sliding fit for the ends of the shafts to be coupled, which are not reduced in diameter. The outside is then finished by slightly tapering toward the ends; it is then key-seated opposite the cast slot and the slot cut through to the hole. Two wrought-iron rings are made, say of one-inch square iron for a two-inch coupling, finished and bored to correspond with the taper of the sleeve just large enough to enter on to the ends of the same to about their own thickness; keys are made to a light driving fit, placed in the slot of shafts, rings and sleeve slid into place, rings driven up on the taper while the shaft is turning slowly to keep them true, and you have a coupling that need give you no concern for its safety, strength or durability. Suppose you wish to disconnect your shafting after running for 15 or 20 years, perhaps in a damp place: a few blows of a hammer knocks off the rings, a wedge driven lightly into the slot loosens both the sleeve and keys, and the coupling slides easily its full length on to one shaft or the other, allowing the removal of either to receive a pulley or for whatever cause. No bolts with inaccessible nuts, no drifting out of keys, no profanity.

W. P. ANTHONY.

N. B.—Since writing the above I have noticed this coupling illustrated and described in the *Journal of the Franklin Institute* for November, 1895.

A shop manager who will go through his works at any part of the running time and note the proportion of his tools that are at the precise time of observation actually cutting work, may be surprised to find the percentage very small. This surprise will set him thinking of means to prevent this waste of time. He will find that perhaps a few lathe dogs are needed extra, so that one piece may be got ready while the other is cut. In most cases this investigation will do good—at least, some good.

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The Fight of the U. S. Naval Engineer Corps.

The appalling list of breakdowns and deaths which have occurred in the U. S. Naval Engineer Corps recently has had the effect of arousing the surviving members of the corps to a realization of the fact that the fight for their rights which they have been carrying on under great disadvantages ever since steam began to be of importance in naval vessels, must be speedily brought to a termination or there will be no one left to either contend for their plain rights or to perform the duties which are the outcome of the fact that a modern naval vessel is, more than anything else, a mass of complicated machinery, requiring, as every one ought to know, specially trained men of high ability to properly and safely manage it.

Senator Squire, who comes from the new State of Washington, but who was for some fifteen years connected with the Remington Arms Company, at Ilion, has made a thorough investigation of the real condition of affairs, and, as a result, has become deeply interested and also firmly convinced that some action by Congress to relieve the present situation is absolutely necessary to avoid serious difficulty.

Senator Squire's connection with the establishment named above makes him familiar with the fact that it is essential to the successful management of any industrial enterprise, or any work requiring division into a number of departments, that the heads of those departments should not only be competent men, but that they should be held responsible; and that their control of affairs within their departments should be exactly commensurate with their responsibility. Therefore the bill which he introduced in the Senate on the 10th inst. is designed to do, and if passed will do, just what any experienced and successful manager of an industrial establishment would upon examination be sure to say must be done sooner or later if the navy is to be further developed or even maintained in its present condition. In introducing his bill, Mr. Squire addressed the Senate in terms showing that he thoroughly understands the subject and that he is determined to make a strong fight for what he conceives to be a simple question of justice as well as a reform absolutely necessary to be made.

The bill recognizes the relative importance of the mechanical engineering work of the navy by providing for an increase of members of the engineer corps to 303, to consist of eighteen captains, twenty-five commanders, sixty lieutenant-commanders, seventy lieutenants, sixty-five lieutenants of the junior grade, and sixty-five ensigns; these titles to mean what they mean in the case of line officers, and to entitle their holders to all the privileges, rights and pay that pertain to these grades. It changes the title of the bureau from the Bureau of Steam Engineering to the Bureau of Engineering, and places *all* the machinery and all the mechanical engineering work done on naval vessels where it belongs, *i. e.*, under the care of the engineer corps.

It makes the chief officer of that corps hold the rank of rear admiral, and gives him two assistants called inspectors-general, with the rank of commodore.

There are other features in the bill providing for teaching naval engineering in the various properly qualified technological institutions, and for the appointment of a greater number of engineer cadets until the number of engineer officers is brought up to something like that which has been found necessary in other navies and which will do away with the rapid killing off of men by sheer overwork and exhaustion resulting from the familiar fact that "there are five men to ring the engine room bells to one for answering them."

We cannot now stop to discuss the bill in detail, but there is much to be said on nearly every feature of it, and we shall consider it our duty to discuss in future issues, as fairly as we can, the reasons why we think it is a matter of vital importance that this or a very similar bill should be put upon the statute books before the present session of Congress is ended.

The bill will inevitably meet with the bitterest opposition from the line officers and their friends, but this opposition, we are convinced, will have its origin in nothing more than unreasonable conservatism, a desire to cling to old ways because they are old, to retain authority which the march of progress and invention must logically and inevitably place on others specially trained to bear it; and, finally, from an utter failure to perceive that entirely new conditions call for new treatment and new arrangements; that this is pre-eminently the age of engineering—an age in which scarcely anything is undertaken to be done by old methods, but by new ones—by the employment of new machinery and appliances which, in the nature of things, must be designed and managed by engineers competent for the work and free from the intolerable annoyance which always results from interference and meddling by those who do not and in the nature of things cannot in the least understand nine-tenths of the affairs about which they presume to dictate.

The bill, as we shall attempt to show, is nothing more than an expression of common sense founded on experience gained in the management, not only of naval affairs, but of all affairs involving the employment of mechanical or engineering talent and training.

Various Frictions.

The dictionary is never up to date. The industries and the sciences, the inventors and the investigators, make enormous additions to it continually, but it is always defective, and many words must still do double duty. It is generally the old words rather than the new ones which are thus imposed upon, and which in turn aid to mislead the people in their use.

In the list of topical questions prepared for the recent meeting of the American Society of Mechanical Engineers, was one which suggested a division of what is now covered by the word elasticity, so that a distinction may be recognized between the elasticity which permits temporary changes of volume, and that which permits only change of figure. The pressure of other topics to be considered did not allow the question to come up at the meeting, and no discussion was held upon it; but there are strong mechanical reasons for indicating the distinction.

The word friction is perhaps of more frequent use in mechanical discourse than even that of elasticity, and curiously enough it too has a double and a more or less debatable meaning. If we look into any standard English dictionary, we find that friction means simply the rubbing of two things together, but when we look into mechanical works which tell about friction, we learn there that friction is the resistance to the rubbing. The definition of friction is still further complicated by the use of the term rolling friction, meaning the resistance encountered by a round body in rolling along a plane surface. In rolling friction it is difficult to find either the rubbing of surfaces or the resistance to rubbing, the so-called friction then arising rather from the compression of the materials in contact.

The general use of the word friction in a figurative sense is a libel upon it. When so used and applied to the affairs of human intercourse it is always made to mean something that is more or less objectionable. If a meeting is spoken of as going pleasantly and smoothly, the highest praise is meant to be conveyed in the announcement that the meeting was without friction. This is unfair and untrue. There is no such contact of men where they do not drive and help each other along fully as much as they hinder and annoy.

Friction, according to the definitions and the uses of it, stands in mechanics as the most objectionable and costly element, and at the same time the most necessary. The construction and operation of machinery consists largely in the making of compromises between the opposing frictions. Of course power is lost in a machine by the friction of its journals or other sliding surfaces, but what if the same machine is driven by a belt? The adhesion of the belt is termed friction, while the slipping of the belt would certainly be friction, but the successful operation of the machine would only be accomplished by the former while it would be defeated by the latter. In the development of power in the locomotive and in its application to traction the friction of the piston in the cylinder, of the cross-head on the guides, of the axles, of the crank pins, the eccentrics and the various other parts all deduct from the effective power, but the friction between the wheel and the rail is still the only means of realizing any practical effect. If the wheels slip on the rail much of the power is at once lost. The work that is done seems to be after all entirely the overcoming of the various frictions of the train, the axle friction, the rolling friction of the wheels, and the friction of the air against the cars.

While we accomplish our work in the world principally by adjusting these differences of friction, what will reduce the friction at one point and increase it at another helps us to our end. Oil on the journals and sand on the track work together for our purpose. While we spend our time and efforts in making these compensating adjustments of the various frictions, we must not give friction as a whole a bad name, any more than the sailor may curse the wind because it sometimes blows in unfavorable directions.

Literary Notes.

SCIENCE OF MECHANICS. A Critical and Historical Exposition of its Principles. By Dr. Ernst Mach, Professor of Physics in the University of Prague. Translated from the second German edition by Thomas J. McCormack.

This is a book in which a learned lover of the science of mechanics has endeavored to make his readers familiar with the processes of reasoning and of experimenting by which the science of mechanics, as we now know it, has been developed and built up.

In arriving at the truths pertaining to the lever, the inclined plane, the composition of forces, virtual velocities, etc., men first used the simple mechanical appliances, experimented with and reasoned about them. The mathematics and the metaphysics came later. Professor Mach has gone behind the mass of mathematics, has dispensed with the metaphysical obscurities, and has treated mechanics, not as a branch of mathematics, but as one of the physical sciences. Those who are curious to know how the principles of mechanics have been ascertained, from what sources they originated and at the same time to acquire a clearer conception and a firmer grasp of them, will find this book very interesting and very helpful. The author has found it necessary to make some use of the precise language of mathematics, however, and consequently there are some portions of the book which only those who have some acquaintance with mathematics will be able to fully appreciate. The book is finely arranged, printed and bound, and is published by The Open Court Pub. Co., Chicago, Ill. Price, $2.50.

MECHANICAL DRAWING. A Manual for Teachers and Students. By Anson K. Cross, Instructor in the Massachusetts Normal Art School, and in the School of Drawing and Painting Museum of Fine Arts, Boston; Author of Free-Hand Drawing, Light and Shade, etc.

The aim of the author in writing this book is best explained by quoting a part of the preface.

"The following notes are intended for students and for teachers of elementary work, particularly for public school teachers. There are many books on the subjects of projection and working drawings, but none which present the principles in ways suited to the needs of the large number of teachers who are required to give instruction in these subjects in public schools. Most of these teachers have had little instruction in the subjects, and frequently do not understand problems which they are expected to explain. This occurs because too difficult

work is often planned for their grades, and also because the instruction which many public school teachers have received has been so advanced and theoretical that the simple principles which alone are necessary for elementary work have been lost in the attempt to understand descriptive geometry and the drawings of machine and other details, whose nature and use are often not known."

This work is very suitable for class room use, and will, we think, answer well the purpose for which it is designed. It is published by Ginn & Company, Boston, Mass. Price not given.

John Wiley & Sons announce a new book by Prof. R. C. Carpenter on "Heating and Ventilation of Buildings."

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(439) A. H. K., Wilkinsburg, Pa., asks: Is there a standard form of bell and spigot for cast-iron water pipe, and if so where can I find a full description of it? *A.*—You will find an illustration and description of it in Trautwine's "Civil Engineer's Pocket-book," published by John Wiley & Sons, New York.

(440) W. B., Schenectady, N. Y., asks: How can I compute the gears of a compound geared lathe? *A.*—See answer to Question 438, in our issue of December 12th, current volume. 2. What is meant by saying a gear has 6 pitch or 8 pitch? *A.*—A gear, 6 pitch, means that it has 6 teeth for every inch of the diameter of the pitch circle; a gear, 8 pitch, has 8 teeth for every inch of the diameter of the pitch circle. Thus a gear, 8 pitch, and 5 inches diameter at the pitch circle, has $8 \times 5 = 40$ teeth; or a gear, 6 pitch, and 48 teeth, will be $48 \div 6 = 8$ inches diameter at the pitch circle. The terms, 6 pitch, 8 pitch, etc., are called the diametral pitch.

(441) C. S., Cincinnati, O., asks: What is producer gas? *A.*—It is the gas resulting from passing steam and air through a bed of incandescent coal. The coal is held in a receiver or gas producer, fitted with suitable grate bars and other attachments which will maintain the proper incandescence of the fire bed. The quality of this gas will depend on the quality of coal used and the conditions of manufacture. When air alone is passed through the incandescent fuel the resulting gas is termed "air gas." 2. A wagon weighs 2,000 pounds; what force in pounds will be required to start the wagon? *A.*—That depends on the kind and condition of the road over which the wagon is to be hauled. On a good cubical block pavement it will take about 50 pounds per ton of the weight of the wagon; on a good gravel road it may take as high as 140 pounds per ton.

(442) A. B., Philadelphia, writes: A friend of mine claims that in computing the cutting speed of lathe work it is proper to add the rough diameter and the finished diameter together, divide them by 2, and consider that to be the diameter upon which to base calculations of speed, or, in other words, to consider that the real diameter of the piece is a mean between the rough diameter and its diameter after the cut is taken. He says he saw this rule given in a mechanical paper, and he claims it is right, while I claim it is wrong. Will you decide? *A.*—The rule as given is wrong, and the diameter of the work should always be taken in the rough condition, that is, before the tool goes over it. To see the absurdity of the rule it is only necessary to consider that if we are turning a shaft of a given size and are taking a very heavy cut from it, the rule would call for a higher speed than would be the case if we were taking a light cut, simply because with the heavier cut the mean diameter between the rough and the finished size would be less. In such calculations it is always correct to take the rough diameter.

(443) H. C. P., Philadelphia, writes: I want to get some information on condensing steam by air, such, for example, as the exhaust from an engine; can such a thing be done? Is it possible, as a matter of everyday practice? Do you know whether such a thing has been done or proposed before, and if in published form, where can I find it? *A.*—Our answer to Question No. 205, on page 389 of the current volume, gives a method of computing the volume of air required for condensing a given volume of steam. In places where water is scarce the practice of condensing steam by means of air is sometimes employed. The current of steam is subdivided and led through numerous small, thin pipes, arranged somewhat closely, and preferably in a shape in which the hight is the largest dimension, as in a tower, and a small quantity of water is led to the top of the coils and allowed to trickle over the external surface of the pipes. The steam may, of course, be condensed without the water, but a much larger pipe surface will be required. We are unable to refer to any published matter upon this topic.

(444) A. B., New York, writes: An upright boiler carries a steam pressure of 50 pounds per gage. The steam passes through a coil inclosed in a cylindrical shell and imparts its heat to 600 pounds of water which is to be heated from 55 degrees to 298 degrees Fahr. What number of British thermal units will be imparted to raise this quantity of water the required 243 degrees? *A.*—147,000 units of heat. 2. What would be the necessary superficial area in square feet of the immersed coil to accomplish this result in one hour's time, neglecting all friction, condensation and radiation? *A.*—For the purpose of economy the amount of heating surface should never be less than one, and generally not more than two square feet for each 5,000 British thermal units to be absorbed per hour, though this depends somewhat on the character and location of surface. The range given above is believed to be sufficient to allow for the different conditions in practice, though a far greater range is frequently employed. According to this data you will require for the coils a heating surface of 29.4 to 48.8 square feet. 3. What quantity of square feet of heating surface must be in the upright boiler to accomplish the work practically based on a type capable of evaporating 10 pounds of water per hour per square foot of heating surface from and at 212 degrees? *A.*—In round numbers 16 square feet. We do not believe that you can obtain a boiler which will evaporate 10 pounds of water per square foot of heating surface per hour. A boiler to do this work will have to be much larger.

(445) G. M., Hartford, Conn., writes: In the accompanying sketch, *A B* represents a vertical line, *C D* represents a door hinged at *C* and when closed forming an angle of about 25 degrees with *A B*. The dotted line represents a chain used for opening the door. Will it require a greater pull to start the door from its present position when the chain is fastened at *D* than when fastened at *E*? The line *E C* represents a bar firmly attached to the door; the points *E* and *D* are in the same vertical line, or at the same distance from the line *A B*. *A.*—There is no difference in the pull of chain at starting, or so long as the points of application *E* and *D* are in the same vertical line, but as soon as the door begins to move, the point *E* will approach the line *A B* and the point *D* will recede from the line *A B*, and therefore the pull at *E* will be constantly increased, while at *D* the pull will constantly decrease. 2. Does the angle *E C D* make any difference so long as the points *E* and *D* are at the same distance from the vertical line *A B*? *A.*—No.

American Machinist

(446) R. B. S., Delaware, Ohio, writes: Kindly inform me of the widest pitch of rivets which has or can be kept tight by caulking, in single, double and triple-riveted boiler joints, where the steel is $\frac{5}{16}$ inch, $\frac{1}{4}$ inch and $\frac{3}{8}$ inch thick. I understand that in material $\frac{1}{4}$ inch thick, 4-inch pitch in both single and double-riveted joints has been successfully used. *A.*—Boiler seams are not designed on the basis of the greatest pitch which can be made tight, and consequently this data is of little importance, and, therefore, a sufficient number of tests have not been made, or at least not put on record, for determining this distance. The pitch will also depend on the quality of the material used and the method of treating the sheets. To design a good riveted boiler seam we must take into account the strength of the rivets and the strength of the material between the rivets, and the pitch must be such as to make the strength of the rivets equal to the strength of the material between the rivets. To use a 4 inch pitch for sheets $\frac{1}{4}$ inch thick is bad practice and should not be tolerated. The pitch of rivets for single-riveted lap joints for wrought-iron plates $\frac{1}{2}$ inch thick, punched and not annealed, rivets $\frac{13}{16}$ inch diameter, should be $2\frac{3}{4}$ inches; the pitch of rivets for single-riveted lap joints suitable for wrought-iron plates $\frac{1}{2}$ inch thick, with drilled holes, or steel plates, with iron rivets $\frac{13}{16}$ inch diameter, should be $2\frac{1}{4}$ inches. The pitch of rivets for double-riveted lap joint wrought-iron plates $\frac{1}{2}$ inch, punched and not annealed, rivets $\frac{13}{16}$ inch diameter, should be 3 inches, and the pitch of rivets for double-riveted lap joint suitable for wrought-iron plates $\frac{1}{2}$ inch thick, with drilled holes, or steel plates with iron rivets, should be $2\frac{3}{4}$ inches. In all these cases it is assumed that the plates are of the average quality; for a high grade of material or for a very poor quality the pitch may be somewhat modified. A 4 inch pitch is suitable for double-riveted lap joints wrought-iron plates $\frac{3}{4}$ inch thick, punched, not annealed, rivets $1\frac{1}{8}$ inches diameter.

(447) R. G., Richmond, Va., writes: Please give the greatest safe load which can be carried by a steel I-beam of the following dimensions: Flanges 4 inches wide, thickness at the outside 0.28 inch, thickness at the center 0.6 inch, thickness of web 0.27 inch, depth of beam 9 inches, and length 16 feet. Load to be applied at the center of beam, and supported at each end of beam. Please show how the calculation is made. *A.*—This beam is evidently one of Carnegie, Phipps & Co.'s patterns; the drawing of this section is given in the "Pocket Companion," published by this firm. In the same book is also given the moment of inertia of this section, the neutral axis being perpendicular to the web at the center; this moment of inertia is equal to 84.3. Now with this moment of inertia known the computation becomes very simple, thus: Multiply the working stress in pounds per square inch by the moment of inertia, and divide the product by the clear length in inches between supports, and by one-half the depth of the beam, multiply this quotient by 4, and the result will be the load in pounds which the beam can support at the center. If we express this rule in symbols, we have,

$$\frac{S \times I}{l \times c} \times 4 = W \qquad (1)$$

in which S = working stress in pounds per square inch, I = moment of inertia, l = distance between the supports in inches, c = half the depth of the beam, and W = load in pounds applied at the center of the beam. For the safe working stress of steel 12,000 to 16,000 pounds per square inch is generally taken, let us adopt 12,000 pounds. Since the total length of the beam is 16 feet, we shall assume the distance between the supports is 15 feet = 180 inches. Substituting these values for the symbols in formula (1), or working by the rule as given above, we have:

$$\frac{12{,}000 \times 84.3}{180 \times 4.5} \times 4 = 4{,}995 \text{ pounds}$$

for the safe load of the beam; from this we subtract one-half the weight of the beam; the result will be the net load which the beam will carry. The weight per foot of length of this beam is 21 pounds, the distance between supports is 15 feet, hence we must subtract $\frac{21 \times 15}{2} = 157$ pounds, fraction neglected, from 4,995, which gives us 4,838 pounds for the net load. It is assumed here that the load is gradually applied; if it is suddenly applied the beam will be injured.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 1012.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Patents, write Walter Donaldson & Co., Wash. D. C.

Dynamo castings. E. M. Co., Ronceverte, W. Va.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Model m'k'g and elect'l experim'l work: charges reasonable. F. W. Gardam & Co., 58 Ann St., N. Y.

Best Presses and Dies for all sheet metal work, Ferracute Machine Company, Bridgeton, N. J.

Just issued—Catalog No. 8. Mailed Free. Clayton Air Compressor Works, 28 Cortlandt St., New York.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden Street, Saginaw, Mich.

A book useful to engrs. & steam users, "Hawkins' Instructions for the Boiler Room." $2.50. Catalog free. Theo. Audel & Co., 91 Liberty street, N. Y.

Duplex and special gear cutters, imp. counterbores, cutter and surface grinders, vertical millers, hand punches and shears for sheet metal. R. M. Clough, Tolland, Conn.

Thin emery wheels, for cutting slots, etc., a specialty. The Tanite Co., Stroudsburg, Pa.; 161 Washington Street, New York; 139 East Pearl Street, Cincinnati, Ohio.

"Practical Drawing," by J. G. A. Meyer; used by engineering schools in lieu of text-book; the set of 92 papers sent to any address in the United States for $5. American Machinist, 203 Broadway.

The Chicago Motocycle Contest.

In its issue of July 11, 1895, the *Times-Herald*, of Chicago, announced a "motocycle" race to take place November 2, open to all comers who could show a safe and inoffensive self-propelled vehicle, mounted on not less than three wheels, and carrying not less than two persons. The *Times-Herald* promised $5,000 cash and a 100-penny weight gold medal as prizes, $2,000 and the medal, the latter valued at $250, to go together to the winner, and the remaining $3,000 to be distributed among the less successful contestants according to merit of performance. We in America had previously done very little in the way of self-driven road vehicles. We have had a few machines, invariably steam driven, and some of them have been fairly and even quite good; but steam requires too much attention, is too bulky, and takes too much fire and too much water for use on common roads to make it very likely to come into popular favor, and the horseless carriage as a possibility for general employment may be fairly said to have been not only unknown but almost undreamed of before the motocycle was taken up by Mr. Adams and the *Times-Herald*. There was a different state of things abroad, in Germany, and especially in France, where the "automobile," in the form of a heavy carriage propelled by a single cylinder gasolene motor, is well known, used to a considerable extent for business purposes in Paris, a subject of interest in a great race last year from Paris to Bordeaux, and so common as to attract no particular attention on the road. Here we had one single example of a gas engine driven vehicle in the Pennington motocyle, and another in the Duryea; Pennington of Cincinnati being at Racine, and Duryea of Joliet, Ill., at Springfield, Mass. Of these two machines Pennington had been longer on the road, having begun in 1891, as he states; Duryea began in 1892, and at the time of the *Times-Herald* contest announcement Pennington and Duryea had each a machine on the road, well tried and in pretty fair form for an extended effort, Duryea having adapted his gasolene motor so ingeniously to the usual form of American road vehicle that, except for the absence of horse and shafts, his self-driven carriage at first sight seems very little different from an ordinary top buggy, with a heavy box body. Within that box body, however, Mr. Duryea had managed to put a pair of gasolene motors able to drive his carriage on the 28th day of November, 1895, over about fifty-six miles of extremely difficult travel in about ten hours. The Pennington motocycle, shown in this paper of November 7, 1895, was far away from common carriage lines, being a very low "Victoria," with small wheels and enormous rubber tires (pneumatics, four inches diameter), and a general lowness of effect, which, coupled with its bicycle style of framing, made its appearance very peculiar. Mr. Mueller, of Decatur, Ill., had imported a "patent motor-wagen, No. 450, Benz & Co., Mannheim, Rhenian Motocycle Factory," to quote the entire nameplate on the vehicle, this being a single cylinder gasolene engine-driven, heavy road carriage, which had been in possession of Mr. Mueller for half a year, and in frequent use by him and his son, Oscar Mueller, and hence, being No. 450 of its kind, and so familiar to its owners, far less of an experiment than the Duryea or the Pennington. These three gas-engine-driven machines were the only self-driven road vehicles in the United States the first day of last July, which were far enough advanced beyond the first stages of experiment to be classed as within public knowledge. We had, however, several examples of electrically driven carriages in a forward state. Morris & Salom, of Philadelphia, with their well de-

signed and thoroughly well built "electrobats," were in pretty good form for an effort. Mr. Harold Sturgis, of Chicago, had a large electric-driven machine to carry six passengers well under way, or very nearly completed. The Columbia Perambulator Co., organized with a view to carrying passengers about the World's Exposition grounds in Chicago in 1893, had a large machine built by the late Frederick Dagenhardt in 1894, and there were many others at various points in the country experimenting with electrically driven vehicles.

There was an immediate response from all parts of the United States, and steam, springs, electricity and explosive gas mixtures clamored together for enrolment as the vivifying elements of the coming new servitor of daily life, the "automobile" carriage, the "motor-wagen," or as we have named it finally here the "motocycle," which in the minds of its advocates is to complete the abolition of the horse begun by the bicycle, and leave our streets clean and noiseless, make oats a forgotten crop, and enable the middle class toiler to ride to and from his daily task in his private carriage if he likes.

The Start, Jackson Park, Nov. 28, 1895.

The De la Vergne "Benz," 22, just before the start at Jackson Park, Nov. 28, 1895.

As the days passed each mail brought some new name to the *Times-Herald* list, until there were something like eighty possible contestants in sight at one time, and appearances seemed to warrant the belief that of this number at least one fourth, or a field of, say, fifteen or twenty motocycles, would be on hand to try conclusions on the second day of November. This prospect broadened the views of the projectors of the contest and enlarged its horizon to the magnitude of a notable event, and that all possible useful effect might be gained from the exhibition the preliminary trials before the board of judges to determine the admissibility of the various aspirants to place in the contest was supplemented with a bureau of scientific record, composed of Messrs. Lundie and Sommers, two engineers of Chicago, of whom Mr. Lundie is the mechanical and Mr. Sommers the electrical expert, who devised machinery for making an exhaustive series of actual effect and condition tests, expected to give such a correct record of the total power, power cost, power distribution, and power effect of the machinery of each motocycle entering the contest as should be of very great value to future constructors, inasmuch as no information of the kind is now open to the public.

Washington Driving Park, with its mile of flat track, finely appointed clubhouse, abundant space for spectators and great general conveniences, was secured for use during the tests and preliminary trials.

The Benz "motor-wagen," owned by Mr. Mueller, of Decatur, was present the first day, and Mr. Mueller's Benz "motor-wagen" was present the second day of the week of preliminary test and exhibition; on the third day the Duryea gasolene carriage arrived from Springfield, Mass. This was not the new one designed and nearly completed for this contest by the Duryea Company, but a previous experiment, unique in type, with a pair of athwartships gasolene engines, discarded, but brought out for this race in default of something better, and, as events have proved, certainly among the very best of the automobiles shown up to the present time anywhere.

Later came Morris and Salom, of Philadelphia; with their extremely well designed and well built "electrobats," and finally Pennington came down from Racine with a driving chain which broke on the trip down to the Park, wound round the large driving sprocket and broke it, and made the Pennington "Victoria" show through the entire meeting with only one driving wheel driven; even in this condition the "Victoria" showed a mile in three minutes on the Washington Park track, the Mueller Benz machine doing the same thing in about five minutes, as did the Duryea, which suffered during this meeting from leaking asbestos gaskets, which very greatly reduced the effectiveness of its engines. So the days of the week of preliminary test passed, with hopeful telegrams and letters from the fourscore prospective entries for the first three or four days, and then came cries of despair for the remainder of the days of grace. "Not ready, and cannot be ready in time," was the burden of the wire in the last half of the week, and finally, on the afternoon of November 1st, a conference of the judges of the contest postponed the run to Thanksgiving Day, November 28, 1895, in the belief that at that time a considerable proportion of the entries would be in form to make the trial.

The "Duryea," Washington Park, Oct., 1895.

Examining the Morris-Salom "Electrobat," at Washington Park.

There were on the ground November 1st, and ready to run, the Benz-Mueller motor-wagen, gasolene; the Duryea carriage, gasolene; the Pennington Victoria, gasolene, only one driver available; the Morris and Salom electrobats, and a machine belonging to and exhibited by the Columbia Perambulator Co. These were at the Park November 1st, and, except the Columbia perambulator, were expected to start in the run for a consolation purse of $500 offered by the *Times-Herald* for the best showing on November 2d, the day first set for the $5,000 and medal competition postponed to November 28th. It thus appears that of, say, 75 intending competitors, five only, or one-fifteenth part, were able to show at all on the grounds, and of these five only two finally proved ready to start in the "consolation" run, and of these, as the event showed, but one was fortunate enough to cover the entire course, and so take the entire $500 purse.

Saturday, Nov. 2, 1895, dawned fair and bright, with a moderate temperature and a clean dry track over the hundred-mile projected course of the race from Jackson Park to Lincoln Park, Chicago, via Waukegan. The field had dwindled down to two contestants, the Benz motor-wagen owned by the Muellers, and the Duryea, both gasolene motors. The electrobats did not care to make the attempt, and the Pennington Victoria contented itself with a short run in company with the two competitors, and then left the course and proceeded to Lincoln Park, where it made exhibition runs during the day. The events of the Benz-Mueller-Duryea run were abundantly varied for the Duryea, and terminated ingloriously in a roadside ditch with a smashed front wheel, as a result of avoiding collision with a farm wagon which turned to the left at meeting.

The Benz-Mueller covered the course of 92 miles in 9 h. 30 m., which was corrected by the judges for unavoidable stoppages to 9 h. 22½ m. official time, or nearly 10 miles per hour for the entire course. There was also a loss of 46 min. by the following events:

	Min.	Sec.
Trouble with igniting spark	2	00
Loss of tire	7	00
Adjusting tire second time	3	30
Trouble with spark	2	30
Taking water	4	00
Trouble with spark	3	30
Lost road by fault of bicycle guides	4	00
Supplies at Winetka (water, gasolene, ice)	5	00
Supplies at Waukegan	7	00
Lost at grade crossings	7	30
Total	46	00

The consumption of gasolene for this 92-mile trip was 5½ gallons, or less than half a dollar for fuel cost. The Benz-Mueller came to the winning post fresh and in good order. The ice used was cracked, put in bags and shoveled into the jacket water tanks with regularity, to keep the heat of the cylinder down, and the run was made by Oscar Mueller.

The Pennington Victoria disported itself in Lincoln Park with its one-driver propulsion for the benefit of the curious, and the unlucky Duryea, with its smashed wheel, came home on a freight train, and that was all of the $500 "consolation" run.

In view of possible inclemencies of weather, the Lundie and Sommers testing machine was removed to Wabash Avenue and 16th Street, where the ground floor was fitted with stalls, and the testing machine had added to it an electric motor to drive the apparatus and motocycle under test with extraneous power to determine the friction of the vehicle's own machinery, and on the 21st of November a party assembled to see the beginning of the tests of machines entered for the competition of the 28th.

It is proper to say that the complexion of the attendance both at Washington Park and at the Wabash Avenue place was of the very best, and fully evinced the widespread interest in the motocycle.

Capital was represented by heavy carriage manufacturers and vehicle users, and talent in the presence of many engineers of reputation. In fact, every one present was there with a purpose, backed by capital of either cash or ideas. One prominent carrier of Buffalo was at the Wabash Avenue place, as he put it, "with a wad, to take back the best thing shown, no matter what it was or what it cost," as he intended to be the first in his city to introduce the motocycle in the baggage transfer business.

There was a very strong tendency observable on the part of the gasolene advocates to distinctly disapprove of the storage battery system as a motor for vehicles, and an equally strong but less assertive disposition on the part of the electric exhibitors to defend their choice with every evidence of conviction of its merits. The one single example of a steam-driven motocycle, with a confessedly inadequate boiler, had nothing to say to the public, but in private talk defended his own side of the case with many sound arguments and with perfect confidence. Altogether the attendance at the motocycle tests formed by far the most intelligent and most calmly considerate assemblage of exhibition spectators ever met by the writer, and made enforced presence at these tests a pleasure instead of the dreadful task which an exhibition commonly imposes on an experienced observer.

The tests at 1557 Wabash Avenue began with the Geo. W. Lewis gasolene motocycle,

which has many peculiarities and shows patient study. The results of the tests made by Messrs. Lundie and Sommers will not be given to the public for some time; the tests are neither simple nor direct, nor could any simple or direct tests cover the ground. The results of each test as partially given out informally to the exhibitors corresponded very closely to the expectations of the vehicle owners, and the tabulated results of these tests will undoubtedly be of value to constructors of motocycles in the future, as they will give effects not before compared in any publication, and so must of necessity form the nucleus of what will soon be an extensive literature of motocycle engineering.

The night of November 24th there was a heavy fall of damp snow in Chicago, which the travel of November 25th consolidated into a succession of hard hills and rugged valleys fit to shame any corduroy swamp road ever built in the West. Another heavy fall of snow not so wet came on the night of the 25th, and the morning of the 27th dawned fair and cold, with all the ruts and bumps of the streets and boulevards covered with an even sheet of dry snow, say six inches deep; as the day passed the dry snow was cut into a slate colored slippery sand, causing innumerable falls to pedestrians and horses alike, and making the progress of any vehicle depending on the adhesion of its own wheels to the surface of the road seem an absolute impossibility. Eleven motocycles were considered certain to enter the contest of the next day, but any attempt to cover 54 miles of such roads as the course afforded or was likely to afford on the next day appeared hopeless. An anxious conference was held at 1557 Wabash Avenue, and various plans, such as clearing Washington Park track and stretches of the boulevards, were considered, but it was finally decided to start the machines at 8:30 A. M. over the 54-mile course as previously announced, and at 8:30 several hundred deeply interested spectators gathered in Jackson Park a little east of the 60th Street station of the Illinois Central Railway and witnessed the departure of six motocycles of the probable eleven.

The starters and their racing numbers were as given below:

5. Duryea Motor Wagon Company, Springfield, Mass., gasolene. (American machine throughout.)

7. De la Vergne Refrigerating Machine Company, New York, gasolene. (Large Benz motor. German.)

18. Morris & Salom, Philadelphia, "electrobat." (American.)

19. H. Mueller & Co., Decatur, Ill., gasolene. (Benz, altered by Mueller. German.)

22. R. H. Macy Company, New York, gasolene. (Benz motor, Roger carriage. Foreign. German motor and, I think, carriage by Paris builder.)

25. Sturgis Electric Motocycle, Chicago, electric driven. (American.)

These contestants were started in the following order: At 8:55 the Duryea was off; a minute later the Benz "motor-wagen" belonging to the De la Vergne Refrigerating Company of New York was sent away; R. H. Macy's "Roger" machine left at 8:59, and the Sturgis electric motocycle at 9:01; the Morris & Salom storage battery "electrobat" followed at 9:02; the Mueller "Benz motor-wagen" did not leave until after 10 A. M. Friday night a close inspection of the Mueller machine convinced the writer that its chances for first place were extremely good. It was in perfect order, the engine ran very quietly, and it was in the hands of plucky drivers. The Benz "motor-wagens" are all belt driven from the cranked engine shaft to the countershaft, and chain driven from the countershaft to the wheels. Wednesday night the Muellers thought it best to replace their old leather belts with new ones, and did so, and their trouble began when they started from 16th Street for 60th Street Thursday morning at 7 o'clock. The belts did not hold well on their pulleys, there was trouble with shipper-fingers, and the machine was late at the park, and there the new belts behaved still worse; they were separated by flanges of thin iron only about five-eighths inch high, and two adjacent belts, one cross and one straight, began to ride up on this flange and on each other, and ended by breaking a weld in the thin iron pulley flange. The belts were cut, ends squared and carefully relaced, all to no purpose; the belts were not evenly stretched, and persisted in riding each other; finally the crossed backing belt was taken off altogether, the dividing flange cut in halves with a cold chisel and cast into the snow, and finally the Mueller Benz machine at 10 06 made the sixth actual starter out of the probable eleven of the night before; some of these non-starters did not like the road, and some met with accidents on the way to the meet. The first bunch of five to start met with trouble in deep light snow just west of the I. C. viaduct on 60th Street. The Duryea struggled through unaided, but all of the others had to be helped by hand. The R. H. Macy "Roger" machine was in collision with an Adams Street horse car, and the horse car had the worst of it with a smashed rear dashboard. The Duryea, No. 5, led to Rush and Erie Streets, where it had a stop, and was passed by the Macy "Roger," No. 22; and from that on until the Roger dropped out 5 and 22 were sawing back and forth, first one in the lead and then the other; at Evanston the Duryea, No. 5, was leading the Roger, No. 22, by about five minutes.

The Sturgis storage battery made the longest run of any of the electrics, drawing out at the north end of Lincoln Park, 16 miles from the starting point. The heavy weight of the electric driven contestants told against them over the horrible roads of the course. Six inches of dry loose sand over the boulder-strown bed of a dry watercourse would just about represent the worst parts of Michigan Avenue that day for shape and density, and it was so slippery that foot passengers could hardly cross a street without falling. At Grace Street and Sheridan Drive the Roger, 22, passed at about 11 o'clock; 22 minutes later the Duryea, 5, flew past without a stop, making good time, and the belated Benz-Mueller left the same point at 12:28:30. The Duryea passed the Roger-Macy coming into Evanston, and left Evanston 5 m. in advance. South of Evanston on the return track a cutter containing newspaper men was overturned on a railway crossing; the Duryea was close behind, and took a sheer on the rail and smashed into the cutter before its occupants had time to pick themselves up. No one was hurt, however. In the village of Roger's Park the Roger-Macy, 22, was in collision with a hack which refused the right of way, and had a wheel damaged and its steering gear disabled, but the motocycle managed to reach the second relay station a mile distant, where it lay 80 m. for repairs, leaving at 2:37 P. M.; the Duryea, 5, passed the same point at 1:10 P. M. without a stop. The Mueller, 19, left this second relay station at 3:29. The later part of the run was made in mist and rain, the starting point being reached by the Duryea, No. 5, at 7:18 P. M. The Mueller, No. 19, crossed the finish line at 8:53, only a little behind the Duryea in actual running time. The Roger-Macy, 22, quit the race at California and Ogden Avenues, at 6:15 P. M. At that time 22 was only 25 minutes behind No. 5, and was ahead of No. 19. The Roger motor gave out, and though the crew labored with it until 11:30 P. M., they could not put it in form again, and so abandoned the race. The decision of the judges has not yet been made.

The performance of the Duryea, a strictly American machine, and the German Benz-Mueller and the Roger machines over such trying roads is perhaps the most notable feat of the motocycle. The roads were such that collisions and falling of horses and pedestrians were frequent throughout the day, and it is a matter of the greatest surprise to those conversant with the subject that traction driven vehicles should have been able to make any progress whatever in the face of such obstacles. This *Times-Herald* contest has thus decided, in the face of seemingly unfavorable conditions, questions which a good day and a good track could never have settled, and has given an absolute certainty that wherever a horse can draw a wagon a cheap and easily managed gasolene motor can propel a motocycle.

H. L. A.

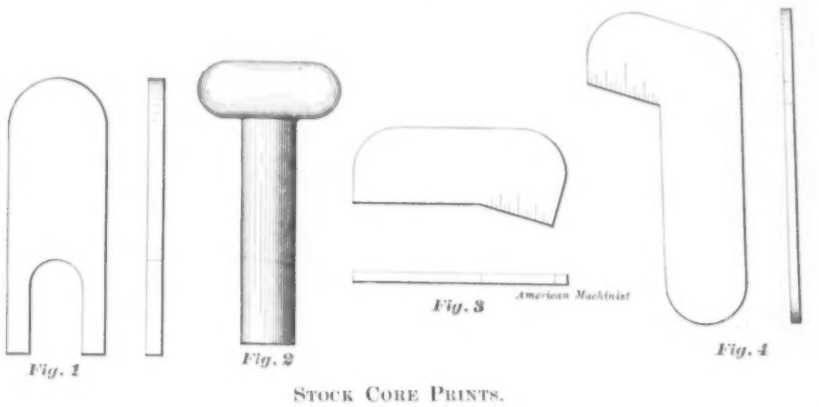


Fig. 1 Fig. 2 Fig. 3 Fig. 4

STOCK CORE PRINTS.

Stock Core Prints.

BY JOHN M. RICHARDSON.

By looking over patterns made in different shops, one notices that the core prints for stock cores are of every length imaginable, and the taper prints have almost every possible angle.

A jobbing foundry must expect all this, and "grin and bear it," but where there is a foundry directly connected with the machine shop and pattern room, uniformity can be reached, and a standard decided on and adhered to.

It is evident that better coring can be done if the taper part of a core exactly fits the corresponding place in the mold.

A good set of stock core boxes is an advantage to any foundry, and those of comparatively small diameter should be made in halves, of iron dowelled together, and be accurately bored out to correct dimensions, so that a whole core may be obtained without pasting. The lengths are not material, but the ends that match the taper prints should have a uniform taper, this being the same for all diameters, and there is probably no better angle for this than 15 degrees. The length of the taper part in the boxes will vary with the diameter of core, and this being decided upon, a standard is found for the patternmaker to turn his core prints to. The diameter of these prints should always be made by standard, and not by shrink rule, for the core will not shrink; and some diameter of shank or spindle must also be arrived at, so that all prints may be interchangeable from one pattern to another, if occasion should require. For this $\frac{3}{4}$ of an inch seems to be a convenient size, and now assuming that all shanks are this diameter they should not be less than $\frac{3}{4}$ of an inch in length.

If a patternmaker is to turn core prints to a standard size, he should be provided with a blue print bearing a table of dimensions and a set of templates should be kept handy somewhere about the lathe. Fig. 1 shows a caliper gage for the shanks; it is made from steel about $\frac{5}{16}$ of an inch thick, having a $\frac{3}{4}$ opening. Fig. 2 shows a plug or sizer to test the holes in the patterns where the shanks to the prints are to fit.

Fig. 3 is a template to use when turning a set of prints between the lathe centers. As both a straight and a taper one are usually turned at the same time, we have only to bring the stock to the proper diameter and let the straight edge of the template rest on what is to be the straight print, and fit the other print to the bevel on the template, using the divisions as a measure to square down on the end for the length. Fig. 4 is another to use when turning a taper print on the screw chuck. First turn the diameter, then square the front face, and turn the bevel, testing it with the template.

The divisions are useful for marking the length, as they are graduated to give true lengths without measuring with a scale.

Nowel prints can usually be the same length as the taper ones, but there are many exceptional cases where it is necessary to have the nowel print much longer, for instance where a core is to stand perpendicularly in the mold for a considerable hight, having no connection with the cope.

Here is a point that the molder will appreciate: See that all prints where stock cores are to be used have the size plainly stamped on them with steel figures or else marked with paint. This saves much calipering in the foundry, and if the core does not fit or correspond to the figure marked, then the pattern room is the place to blame.

It is useless for a patternmaker to go to the time and expense of making core boxes for ordinary straight cores, unless the length is excessive; for every foundry, if it makes any pretensions at all, has a set of core boxes in even eighths of an inch for all ordinary sizes, and in quarter inches at least for larger diameters.

Bids were opened at the Navy Department on December 10th for furnishing two vertical, single-acting, double-cylinder beam air pumps; two horizontal, single, steam pumps for main feed, with steam cylinders, 16 inches; water cylinders, 9½ inches, and common stroke of 16 inches, and three vertical, single, steam pumps, auxiliary feed, with steam cylinders, 12 inches, and common stroke, 12 inches. The above pumps are to be used on the U. S. steamship "Chicago."

The following bids were submitted:

Geo. F. Blake Manufacturing Co., $6,592 for air pumps, and $2,743 for steam pumps.

M. T. Davidson, $5,200 for air pumps; $3,675 for steam pumps.

Manhattan Supply Co., $7,480 for air pumps; $4,154 for steam pumps.

The Secretary of the Navy has rejected all the bids opened on November 12th for anchors for the League Island Navy Yard. New proposals will soon be asked for.

COMMERCIAL REVIEW.

NEW YORK, Friday Evening, Dec. 13.

The Machinery Trade.

Auspices for the coming year continue favorable. It is apparent that, if the manufactured products of iron are allowed to follow their inclinations, next season will see no return to the dulness of 1894. But the movement—or lack of movement—in raw materials will be watched with much anxiety.

As illustrative of the situation in this city, may be given the following informal statement from the New York representative of a well-known Western machinery firm. "Business is better than a month ago: When people buy, they do so with a snap. They want tools directly from stock, and have plenty of money with which to pay for them. Indeed, this latter circumstance makes them so independent as to keep down prices. Among the lines of machines in good selling are millers, engine lathes for tool rooms, upright drills, sensitive drills, and shapers. The bicycle manufacturing tool trade holds on well, and will probably continue to do so for a month. Factories are running on night turn to keep up with it." Most other companies have found that for the last few weeks bicycle tools have been a little quieter.

The early termination of the strike of the housesmiths has averted the consequences which might have ensued in the woodworking machinery business. It is also becoming a little easier to collect money from purchasers in this industry. In hoists and freight elevators there is a fair amount of activity this season, but prices are being cut.

The Standard Tool Company reports of the twist drill branch of the market that not only have jobbers taken large supplies, but the goods are moving to consumers. Its factory is running on full time with

more men than ever. Prices are low, and likely to remain so. The company anticipates dulness next month. Nevertheless we think there ought to be a good demand for drills, in common with other lines of machinist's supplies, early in the winter when stocks are taken. Trade in emery wheels in this vicinity, as experienced by the same company, has not been so great in any other December for three years. Holding steady until the latter part of September, it rose in October to double its former volume.

Engines, Boilers and Pumps.

In this market, as is well known, engines for electric lighting take a foremost rank. There is a great tendency to employ isolated plants for that purpose, and hence a great many small and medium-sized engines are sold. Mr. J. H. McEwen finds that the sizes most in demand average about 175 horse-power, or, for city use, somewhat smaller, and reports his business for the last six weeks as better than ever before. Another party thinks the engine trade a trifle dull, but mentions having marketed two or three to be installed during the holiday shutdown.

The following summary of business in boilers as experienced by Abendroth & Root is probably applicable to that of other high-class manufacturers: "Very busy; better trade than last year; brisk for the past six months and no falling off now; outlook encouraging; no weakness in price with that of materials; a good business also in spiral riveted pipe, which is a substitute for ordinary wrought-iron pipe."

In steam pumps December is naturally an active month, but the present one is unusually so, says the Deane Company.

Wrought-iron pipe is unsteady and weaker. It is likely to go even a little lower than its present quotations before reaching bottom. The trouble is not due to idleness of the mills, as some are worked to their full capacity. With certain parties pressure to sell exists; yet, on the part of other manufacturers, there is a tendency to take a philosophical view of the situation and wait for business until after the first of the year. Little is doing in pipe fittings. Those of cast-iron are weakening in price, while the malleable iron ones are somewhat firmer.

The Kennedy Valve Manufacturing Co. reports so much business in valves, hydrants, etc., that for the last three or four months its works have been running 23 hours a day. Prices, however, are weak, and tend to become still weaker.

Iron and Other Metals.

The pig iron market seems to have relapsed into as intense a dulness as that of a year ago, but prices fortunately have not fallen to the same level, although low enough. There is sufficient iron sold to emphasize the small figures to which the market has quietly been creeping down. Some Bessemer pig is said to have offered at Valley furnace recently at less than $12. One hopeful feature of the situation is that inquiries are coming in for prices on quantities of iron to last through the year of 1896. When buyers think of stocking up in this way, it indicates that they look for higher prices. The question of the hour is whether consumption will hold its own. The belief is that if it keeps up fairly well the amount of iron now being made can be disposed of. Machinery steel and cold rolled steel shafting are steady. In these lines little business is now to be expected.

There is still but moderate domestic buying of copper, and for this the exports are not enough to compensate. Prices are not all holding their own.

Block tin is still being jostled to and fro by speculation. The foreign market has been weak, and the domestic quotations have inevitably followed suit. Stocks on hand in this country and Europe sum up to a very weighty total.

The lead market remains dull. The buying side is indifferent and disinclined to give its gold in exchange for the baser metal. There is a tendency to hold off until after January 1st. The price has become somewhat lower.

Spelter is in much the same condition as lead. Trade shows no animation and the price is easy.

QUOTATIONS.

SATURDAY EVENING.

Iron—American pig:		
No. 1 foundry, Northern	$13 25	a14 00
No. 2 foundry, Northern	12 50	a13 00
No. 2 plain, Northern	12 00	a12 50
Gray forge, Northern	12 00	a12 25
No. 1 foundry, Southern	13 50	a14 00
No. 2 foundry, Southern	13 00	a13 50
No. 3	12 50	a13 00
No. 1 soft, Southern	13 00	a13 50
No. 2 soft, Southern	12 50	a13 00
Foundry forge, Southern	12 00	a12 25

Bar Iron—Common, on dock, 1.35 a 1.40c.; refined, on dock, 1.50 a 1.60c.

Tool Steel—Ordinary sizes, standard quality, 6 a 7c.; extra grades, 11 a 12c.; special grades, 16c. and upward.

Machinery Steel—1.85 a 1.95c. for ordinary brands. Special brands upward.

Cold Rolled Steel Shafting—Base, 2¼c. in car loads; 2¾c. in smaller quantities; 3c. from store.

Wrought-iron pipe—Base discounts; small black, 57; small galvanized, 52; large black, 67; large galvanized, 55. Beyond this four 10s and about 2½ extra may be obtained.

Boiler Tubes—We still quote nominal discounts. On 2 and 2¼ in., 67½ and 5; on 2½ in. and larger, 70 and 5. These prices are cut however, and a large order might call forth a concession of 10 per cent.

Copper—Lake Superior ingot, 10⅛ a 10⅜c.; electrolytic, 10¼ a 10⅜c.; casting copper, 10 a 10⅛c.

Tin—Current month, 13.95c. net; January, 13.85c.

Lead—Common Western, 3.20 a 3.25c., in car load lots.

Spelter—Western brands, 3.40 a 3.50c., New York delivery.

Antimony—Cookson's, 7¾ a 8c.; Hallett's, 6¾ a 7c.; Japanese, 6¾ a 6¾c.

Lard Oil—Prime city, 51 a 53c.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9" × 12", 6" × 9" and 4½" × 6". We recommend the 6" × 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

Morris Tasker & Co., of 222 and 224 S. Third street, Philadelphia, Pa., send us a price list and catalog of charcoal iron boiler tubes, standard wrought iron butt-welded and lap-welded pipe, etc. The catalog contains a good deal of condensed information regarding sizes, weights, etc., and will be found useful by those who have to do with piping. It is 4¾"x7¼".

We have received from the Ansonia Brass and Copper Co., 19 and 21 Cliff street, New York City, a small pamphlet devoted to Tobin bronze, of which the above company is the manufacturer. The pamphlet directs special attention to the result of tension, torsional, transverse, and crushing tests of Tobin bronze, made by N. O. Olsen, of New York, on a Fairbanks testing machine. The pamphlet will be found interesting to machinery constructors, and is sent on application.

MANUFACTURES

The Elmore Drill Co., Dubuque, Ia., has been organized with a capital of $100,000.

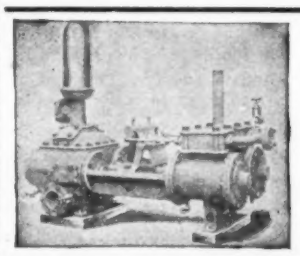
A new water-works system, also a new electric plant, is to be inaugurated at Angelica, N. Y. Messrs. Blair, Fletcher and Weaver are appointed water commissioners.

The big furnaces of the McShane Foundry Co., at St Helen, Md., started recently, giving employment to 350 men who were forced into idleness several weeks ago through the breaking down of machinery.

The King O'Hara Co. has been organized at Chicago, and has a factory at 67 and 69 South Canal street, in that city. Mr. P. F. King, a well-known inventor in safe construction, is vice-president and general manager.

The Berlin Iron Bridge Co., of East Berlin, Conn. have just completed for the Standard Oil Co., at Constable Hook, N. J., a compounding building 120 feet wide by 130 feet long. The roof trusses are composed of steel with steel purlins and covered with galvanized corrugated iron

The Haugh-Noelke Iron Works at Indianapolis, Ind., have been completed, and are equipped with the most modern machinery. The plant consists of five large buildings, built of brick, having a frontage of 500 feet. The incorporators are Frederick Noelke, president; B. F. Haugh, vice-president, and C. F. Waterman, secretary and treasurer.



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"ENOUGH SAID."
PROVIDENCE, R. I., November 25, 1895.
THE MASON REGULATOR CO., Boston, Mass.
GENTLEMEN:—We are aware that this account is less than a week old, but we are fearful that you do not know what a good thing you have sold us, and for fear you will ask us to send it back we think it best to remit for it immediately. We have the pump in operation and it is absolute perfection. Yours truly, GEO. W. STAFFORD MFG. CO.

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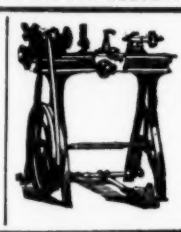

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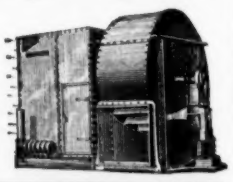

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CHICAGO. BOSTON. PHILADELPHIA.

Mr. Henry Dreses, who, for some years past, has been chief designer and draftsman with the Lodge-Davis Machine Tool Co., and Mr. Oscar Mueller, who was for some years superintendent of the Cincinnati Milling Machine Co., have organized the firm of Dreses, Mueller & Co., and will build machine tools in Cincinnati. They have built and equipped a shop there and expect to employ about fifty men for the present. Messrs. Dawson & Goodwin, of 57 South Canal street, will be their agents in Chicago.

The Lodge & Davis Machine Tool Co., of Cincinnati, Ohio, are now working 400 men 14 hours per day, and are making some extensive additions to enable them to handle their increasing business. They are now excavating for the purpose of putting a basement under their entire plant, which will enable them to remove cutting-off machines, grinders, surplus steel, castings, etc., from the upper floors, and thus provide many hundred feet of space which will be sufficient room for the addition of such machinery as may be required in supplying their orders. The demand from bicycle factories and the picking up of trade in all lines generally has occasioned these extensions.

The Jones & Lamson Machine Co., Springfield, Vt., have recently placed some of their 2x24 flat turret lathes in the following shops: Prentiss Bros., Worcester, Mass.; A. Janssens, Paris, France; N. Y., L. E. & West. R. R. Co., Meadville, Pa; U. S. Metallic Packing Co., Philadelphia, Pa.; Cushman Chuck Co., Hartford, Conn.; Knowles Steam Pump Works, Warren, Mass; Hotchkiss Ordnance Co., Providence, R. I.; Watertown Steam Engine Co., Watertown, N. Y.; Buckeye Mfg. Co., Anderson, Ind.; Southern Railway Co., Alexandria, Pa.; M. Koyemann, Dusseldorf, Germany.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Draftsman, exp'd on steam and gen. machinery; shop experience. Address Box 185, AM. MACHINIST.

Wanted—Work by two young machinists; West preferred. Address E. S. Cruse, Piqua, Ohio.

Foreman blacksmith desires situation; large experience light and heavy forgings; can handle men best advantage; best refs. Hustler, AM. MACH.

Superintendent wanted in a machine screw shop doing considerable bicycle work; only first class men need apply. "Cleveland," AM. MACHINIST.

Position wanted by a practical mechanic of 21 years' exp. in shop and drawing office; has had charge of work and men. B. S., AM. MACHINIST.

Wanted—Position, 14 years' experience as machinist and draftsman on locomotive and electrical machinery, tools, jigs, etc.; experienced erecting architectural iron work. Box 183, AM. MACHINIST.

Wanted—Position by young man familiar with the forcing of machine tools to get their best production as basis for piecework rates. Address Box 179, care of AMERICAN MACHINIST.

Wanted—A first-class draftsman by one of the largest shops; prefer a man who has had experience on Corliss engine work and heavy machinery. Address Box 162, AMERICAN MACHINIST.

Engineer with 12 years' practice in U. S. intending to return to Germany, desires to correspond with manufacturers who wish to introduce their goods. Address Box 189, AMERICAN MACHINIST.

Machinist with technical education, 7 years' shop and 11 years' drawing-room experience, desires a situation as designer or draftsman. Address Age 37, care AMERICAN MACHINIST.

Wanted—Foreman for brass foundry out of the city working 10 or 12 molders; light and medium heavy work; good job for the right man. Address Composition, care AM. MACHINIST.

Wanted—Work by mechanical engineer (Stevens graduate, 1886) in either works or drafting room; experienced in design of both light and heavy work; 4 years' shop and construction experience. Address Box 178, care AMERICAN MACHINIST.

Wanted—Work as draftsman by man having experience in both shop and drafting room; technical education. Address Box 167, care AMERICAN MACHINIST.

Wanted—Position as foreman in the manufacture of drawing presses, punching, shearing dies, designing special tools and automatic machines and bicycle work; capable of handling men and turning out work. Box 184, AM. MACHINIST.

Wanted—Foreman boilermaker and layer out for shop having about 25 hands; competent to get out work at lowest cost; must be temperate; state wages wanted. Address Boiler, care Parvin Advertising Agency, Cincinnati, Ohio.

Wanted—By a Western technical school an instructor in blacksmithing; preference will be given to the candidate who is also a practical machinist or an exper'd engineer. Address, with references, stating wages expected, Blacksmith, AM. MACH.

A young man who has had experience on the road, also practical machinist, would like to engage with good house as salesman handling machine tools or mill supplies; reference from present employer. "Paul," care AM. MACHINIST.

A practical brass foundry foreman desires position; 17 years' experience handling men; acquainted with all modern ways of turning out castings quickly and cheaply; best of ref.; engineer and plumbers' supplies p'f'd. Brass, AM. MACHINIST.

Chief draftsman desires position as assistant to engineer or manager or in charge of drawing room at works; technical training; experience with first-class concerns; paper mill, marine and gen. mach'y; boilers, locomotives. Box 187, AMER. MACHINIST.

(*Continued on Page* 1014).

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Office and Works,
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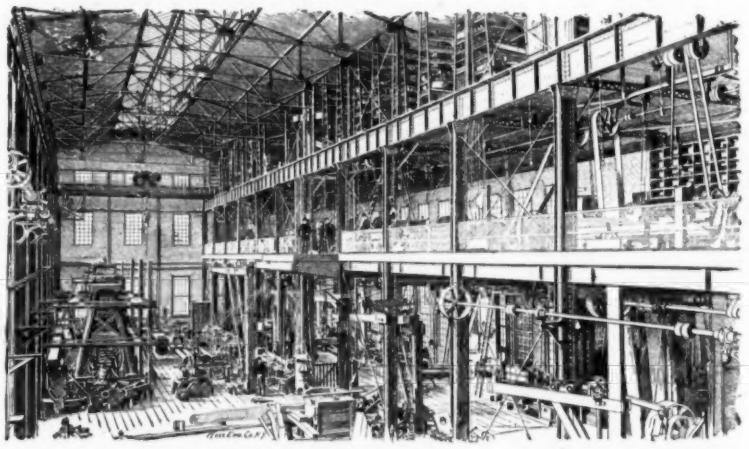

Iron and Steel Bridges and Buildings.

The above illustration is taken direct from a photograph, and shows the interior of a Machine Shop designed and built by us for The Dry Dock Engine Co., at Detroit, Mich. The central portion, or Erecting Room, is 40 feet wide, with a gallery three stories high on one side, this gallery being 27 feet in width. The upper floor of the gallery is used for storing patterns, while the second floor is used for light machine work and the lower floor for heavy machine work—this lower floor being controlled by jib cranes, which also swing out into the central portion, thus delivering material from the wings by the means of jib cranes and the traveling crane to any portion of the Erecting Room. The whole framework of the building is of Iron, with brick filling for the side walls.

SEND FOR OUR ILLUSTRATED CATALOGUE.

Science of Mechanics.
A Critical and Historical Exposition of its Principles. By Ernst Mach. Translated by Thos. J. McCormack. 250 cuts, 534 pp., half morocco, $2.50.
"A careful study of Professor Mach's works, and a treatment with more experimental illustration, on the lines laid down in the interesting diagrams of his Science of Mechanics, will do much to revivify theoretical mechanical science, as developed from the elements by rigorous logical treatment." Prof. A. G. Greenhill, in Nature.
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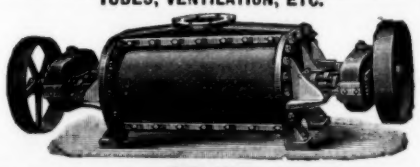

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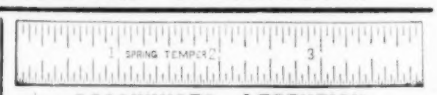

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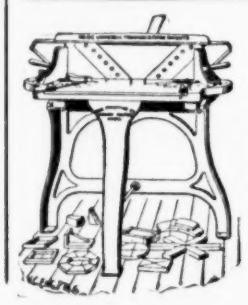

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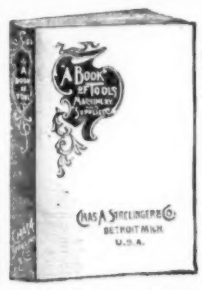

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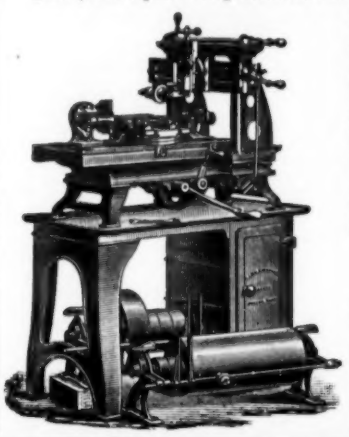

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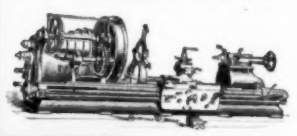

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SIMPLE, COMPOUND, OR TRIPLE EXPANSION, HORIZONTAL OR VERTICAL
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Wanted—Position as superintendent of a machine works, or as designer; experienced in making sales; would like the privilege of purchasing an interest in the business. Address Box 180, care of AMERICAN MACHINIST.

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Wanted—A draftsman and constructing engineer of 25 years' experience in designing and erecting work of all kinds both in this country and West Indies desires to connect himself with a contracting and engineering concern, or with some manufacturing concern, as superintendent or assistant manager, or to take the New York management of some steam or hydraulic manufacturing concern on salary or commission. Address Hydraulic, Box 186, care of AMERICAN MACHINIST.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 3d hd lathes & planers. S.M.York, Clev'd, O.

Calipers & Gauges. P. A. Welles, Milwaukee, Wis.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

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For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

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Machinists should go to Tucker's, 135 Greenwich St., N. Y. City, and examine "Crane's Patent Portable Hand Drill," four sizes; something new.

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No charge for the groove in the shanks.

Send for Descriptive Price List.

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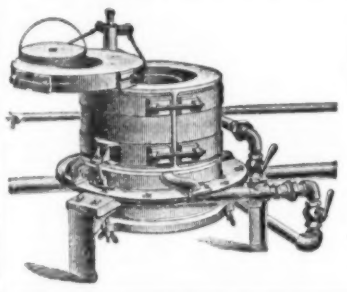

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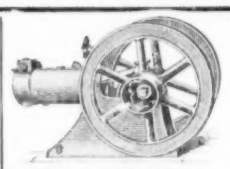

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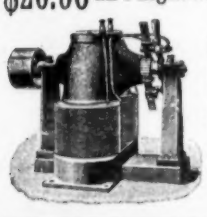

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1 16 in. x 6 ft. Blaisdell with rise and fall rest.
1 18 in. x 6 ft. Hendey with plain rest.
1 18 in. x 10 ft. Blaisdell with plain rest.
1 18 in. x 10 ft. Flather & Co. with plain rest.
1 20 in. x 10 ft. Flather & Co. with compound rest and chuck.
1 21 in. x 8 ft. Lodge & Davis with compound rest.
1 22 in. x 10 ft. Lodge & Davis with compound rest and chuck.
1 22 in. x 8 ft. Blaisdell with plain rest.
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1 5 ft. Universal Radial Drill Press.
1 No. 14 Brainard Universal Milling Machine.
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1 40 in. New Haven Drill Press, back gear, power feed.
9 12 x 5 Speed Lathes, complete.

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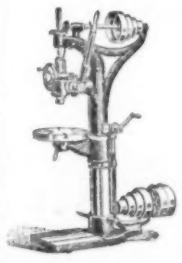

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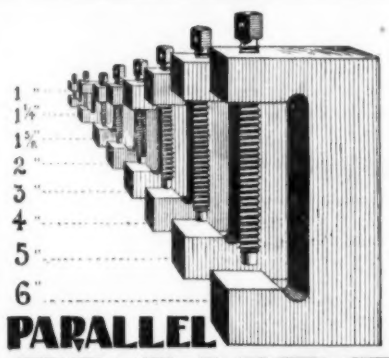

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1 1/4"
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FINE TOOLS
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21 in. Gould & Eberhardt Drill. Good as new.
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1 16 in. x 8 ft. Flather.
2 18 in. x 8 ft. Flather & Prentice.
5 18 in. x 8 ft. Lodge & Davis.
2 21 in. x 10 ft. Pratt & Whitney.
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1 28 in. x 12 ft. Blaisdell.
2 30 in. x 14 ft. Lincoln.
1 32 in. x 13 ft. Bement Triple Geared.
1 22 in. x 10 ft. Niles.
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1 48 in. x 18 ft. Gay & Silver.

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1 36 in. x 36 in. x 10 ft. Aldrich.
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1 60 in. x 60 in. x 22 ft. Hepworth.

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3 22 in. Back Geared.
2 25 in. " & P. F., Snyder.
1 34 in " " Harris.
2 No. 1½ Niles Radial.
3 Suspension Drills.

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1 No. 1 B. & Sharpe.
2 No. 13 Garvin.
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9 in., 12 in., 13 in., 15 in., 20 in.

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2 Horiz. B. & D. Machines.
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1 30 in. Motor Gear Lathe
1 Double Punch and Shear.
1 30 in. Pulley Lathe.
1 Hydraulic Riveter.
2 Bolt Cutters.
1 Nut Tapper.
1 20 in. Pattern Lathe.

Also large stock of other tools. Send for List.

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BEFORE REMOVAL.

At Phœnix Iron Works, Trenton, N. J.

15 in. x 6 ft. Engine Lathe.
22 " 12 " " "
29 " 13½ " " "
26 " 20 " " "
37 " 30 " " "
71 " 18 " " "
51 in. x 18 ft. Engine Lathe.

19-36 and 50 in. Drills.
Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
Gear Cutter, 54 in.
Milling Machine.

10 ft.-16 ft. Vertical Boring and Turning Mill, Cranes, Blower, Boiler Rolls, Punch and Shear, etc.

Send for full list and prices.

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IN FIRST-CLASS CONDITION.

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One (1) 5 ft. Universal Radial Drill.
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19 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
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40 in. Bement Vertical Drilling Machine.
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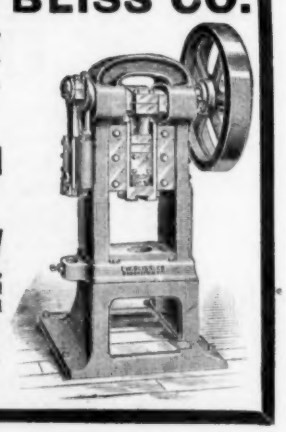

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at very low prices before removal.

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" 42 " " risers to 48 in., 12 ft. bed, Triple Geared, Compound Rest, etc., Pratt & Whitney's. A 1 order
" 32 in. swing risers to 36 in., 8 ft. bed, Compound Rest, etc., Fay & Scott's, A 1 order.
" 24 in. swing, 12 ft. bed, Compound Rest Fitchburg.
" 22 in. swing, 12 ft. bed, Cp'd Rest, 1 9-16 hole, Perkins.
" 20 in. swing, 15 ft. bed, Extra Heavy, Cp'd Rest, Pond.
" 18 in. swing, 8 ft. bed, Flather.
" 16 in. swing, 7 ft. bed, Pratt & Whitney.
" 13 in. swing, 6 ft. bed, Blaisdell.
PLANER—37 in. x 37 in. x 11 ft., Betts.
" 36 in. x 36 in. x 8 ft., Niles.
" 32 in. x 32 in. x 8 ft., Pond.
" 26 in. x 26 in. x 8 ft., Powell.
" 26 in. x 26 in. x 8 ft., Gould & Eberhardt.
" 24 in. x 24 in. x 6 ft., Lathe and Morse.
" 22 in. x 22 in. x 5 ft., Pease.
SHAPER—10 in. Stroke Crank, Hewes & Phillips.
" 15 in. " " Gould & Eberhardt.
" 17 in. " " Prentiss.
" 18 in. " Geared, Improved.
" 24 in " Friction, Hendey.
" 14 in. " Traveling Head, Warren.
DRILL—16 in. Plain, Prentiss.
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" 32 in. " " Extra Heavy, Pond.
" Radial 3 ft. arm, Hilles & Jones.
Universal Milling Machine, Kempsmith's latest.
" " " Cincinnati No. 3.
Plain " " Lincoln Pattern.
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Upright Boring & Turning Mill, 38 in., 2 Heads.
Horizontal Boring & Driding Machine, Sellers, 54 in.
Pipe Machine, 6 in., with Engine, Jarecki.
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Plate Planer, 16 ft., Niles. A 1 order.
Boiler Punches, 22 and 36 in. gaps.
Boiler Rolls, 6, 7, 8 and 10 ft. wide.

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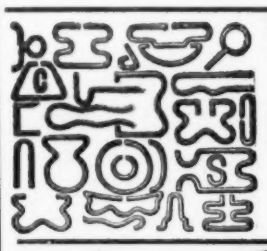

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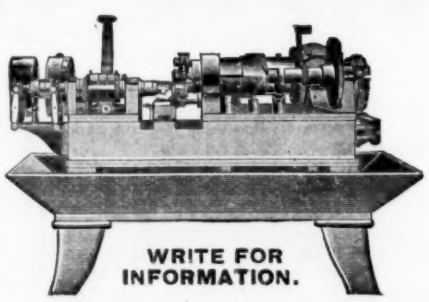

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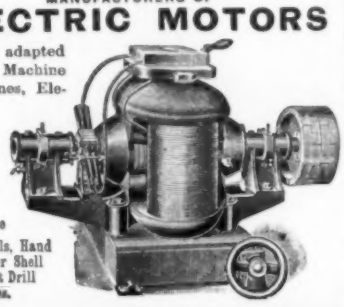

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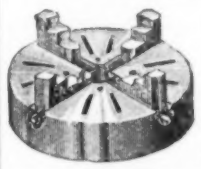

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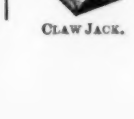

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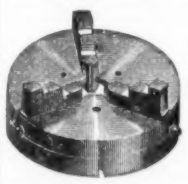

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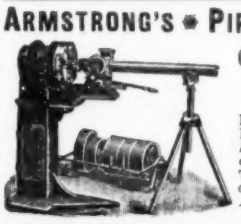

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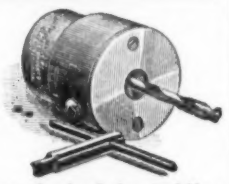

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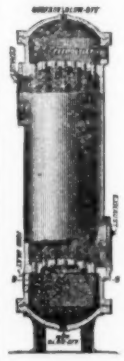

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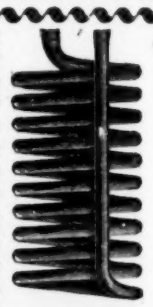

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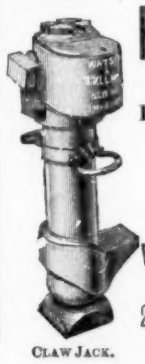

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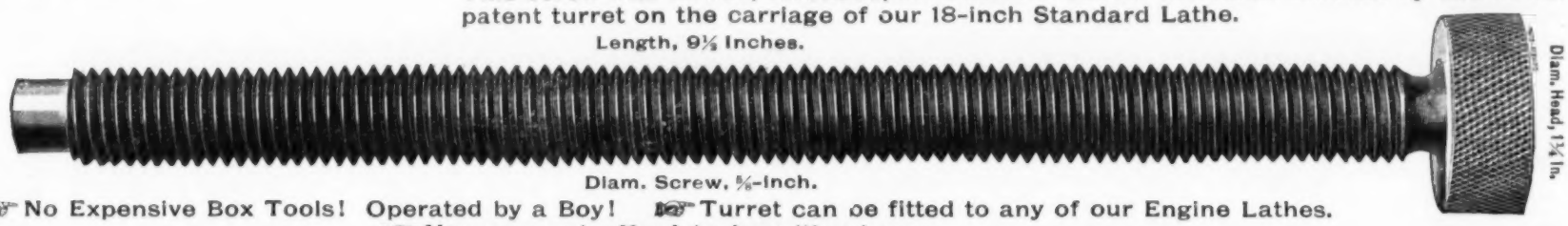

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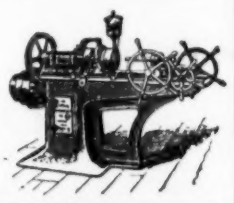

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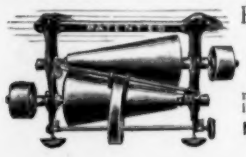

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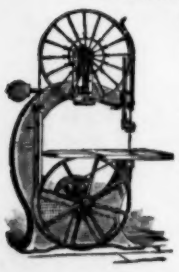

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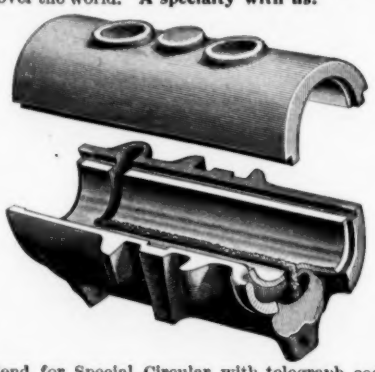

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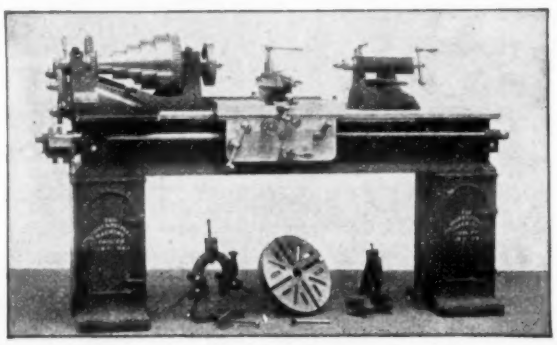

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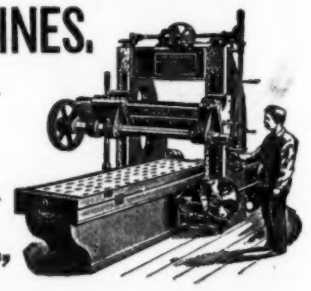

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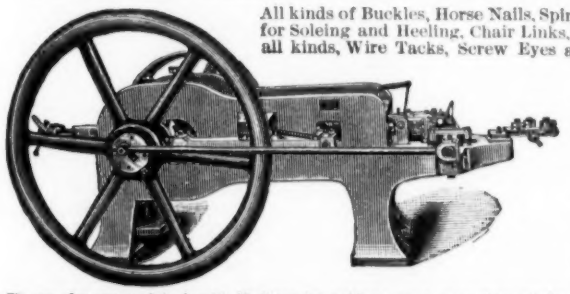

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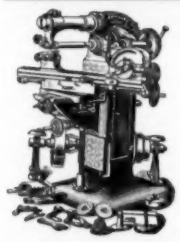

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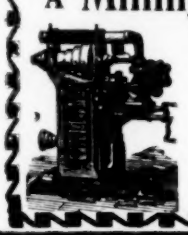

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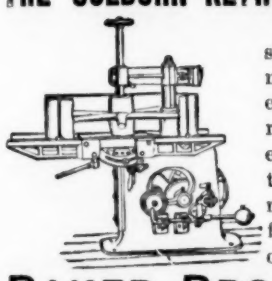

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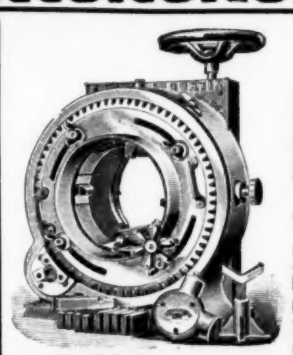

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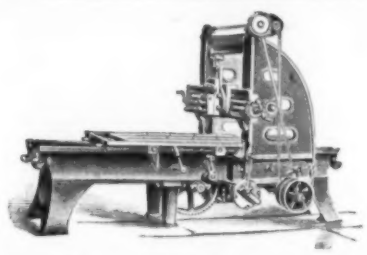

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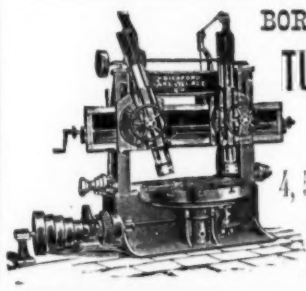

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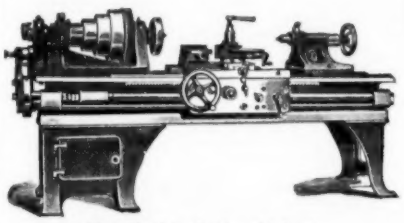

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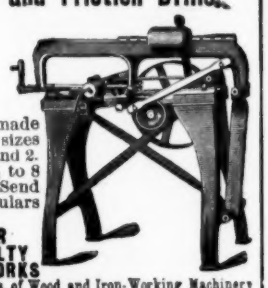

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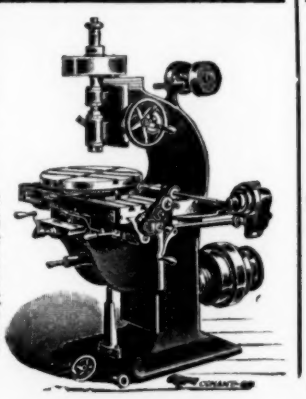

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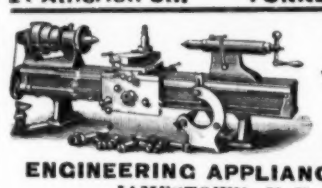

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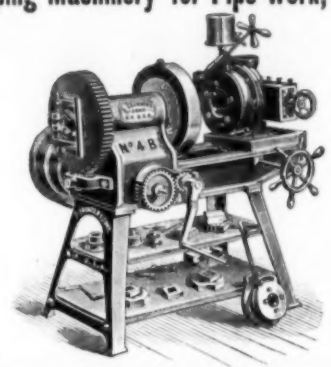

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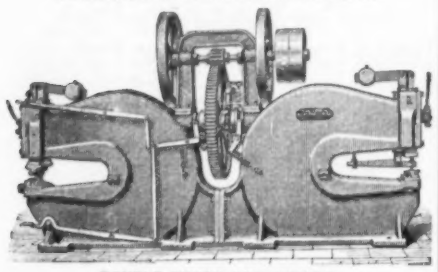

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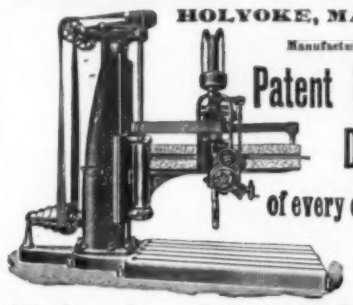

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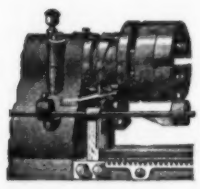

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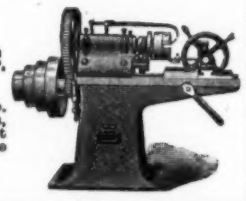

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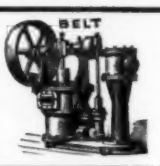

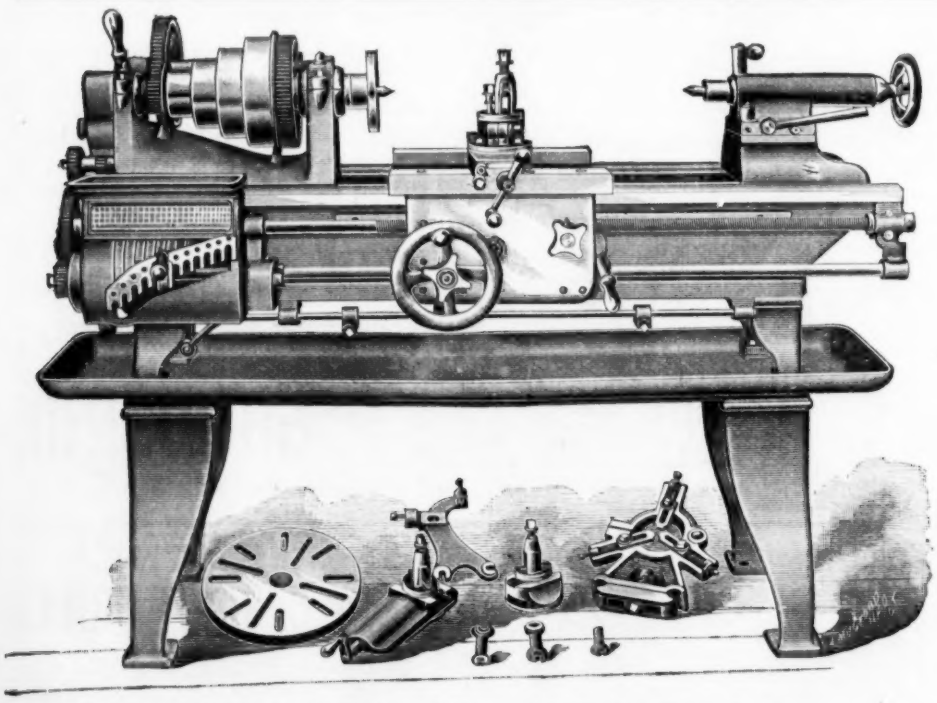

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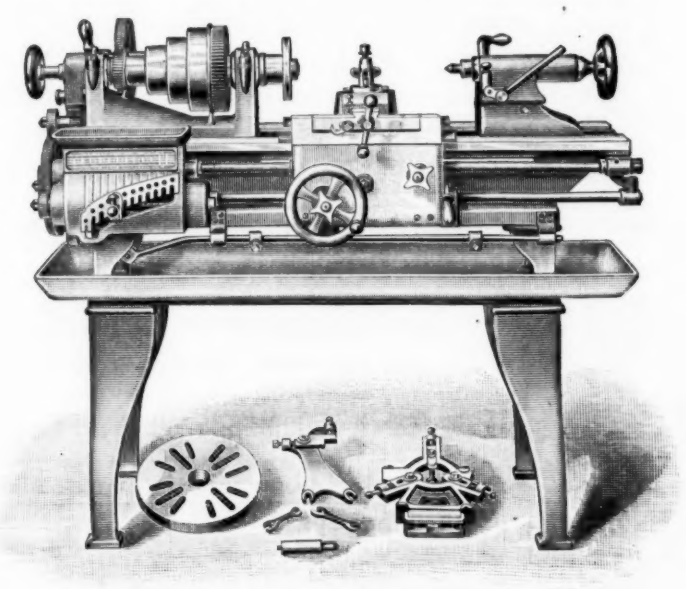

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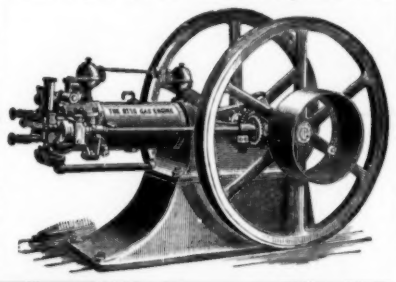

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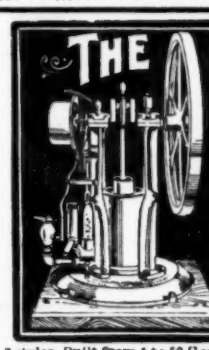

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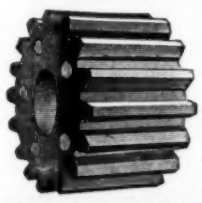

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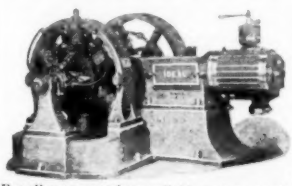

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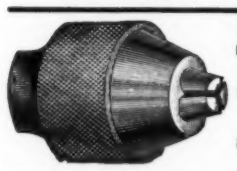

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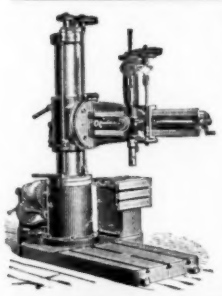

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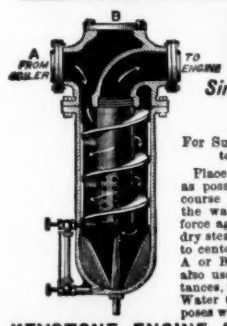

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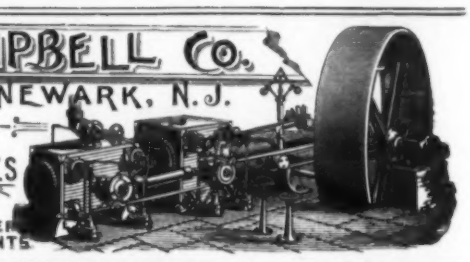

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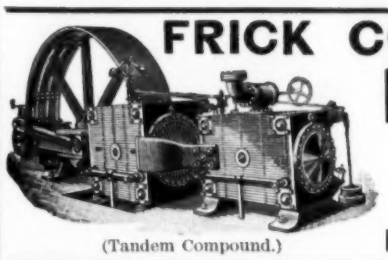

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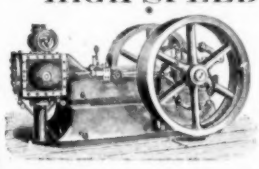

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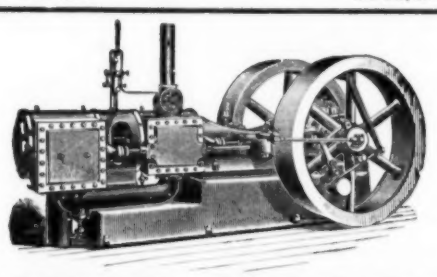

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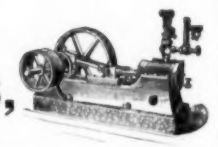

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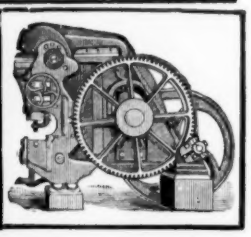

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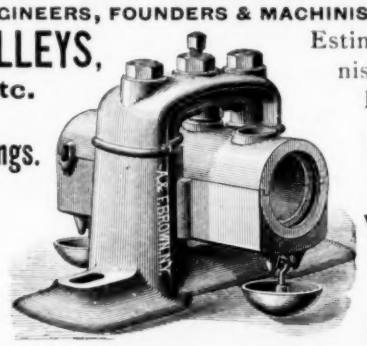

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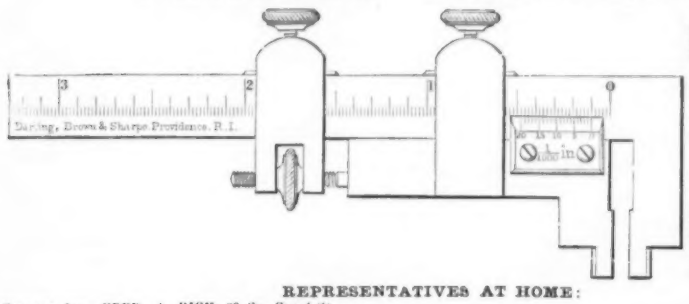

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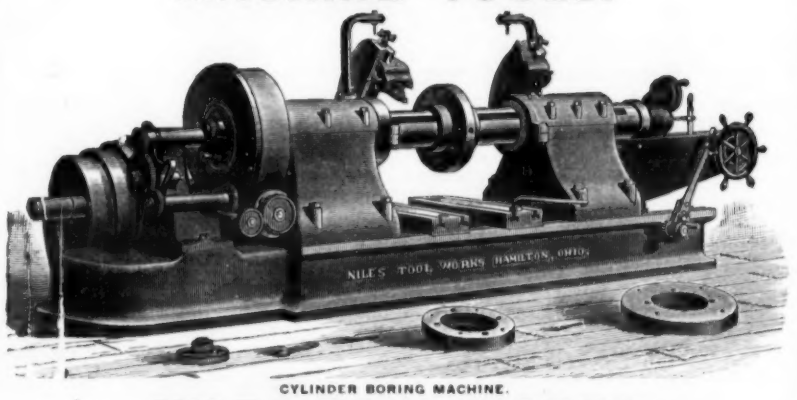

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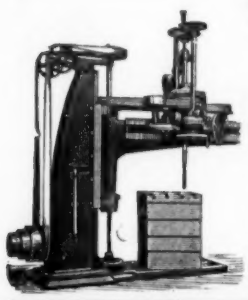

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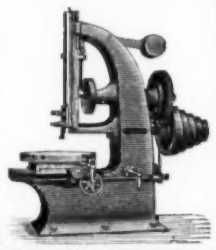

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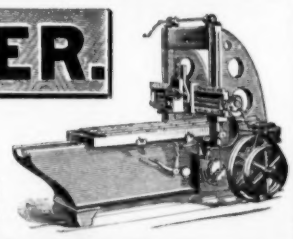

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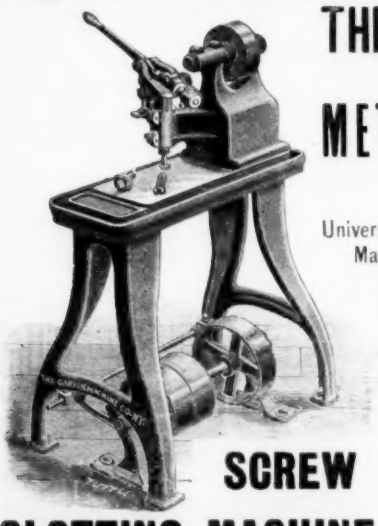

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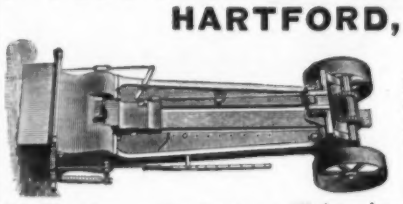

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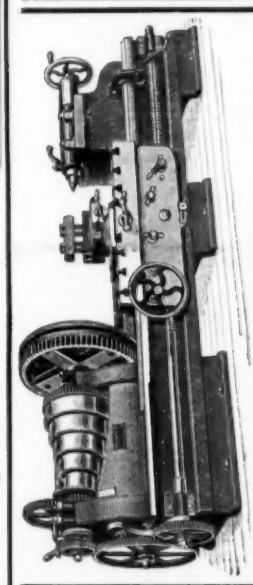

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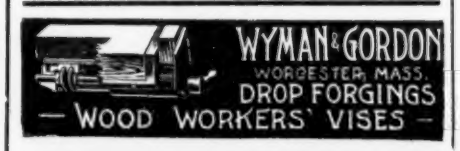

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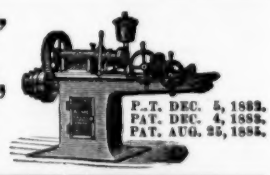

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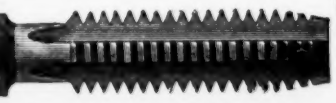

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